



TITLE:

# FLORA DESMIDIARUM JAPONICARUM VI

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CITATION:

HIRANO, Minoru. FLORA DESMIDIARUM JAPONICARUM VI. Contributions from the Biological Laboratory, Kyoto University 1959, 9: 302

ISSUE DATE:

1959-12-05

URL:

<http://hdl.handle.net/2433/155915>

RIGHT:

# Flora Desmidiarum Japonicarum VI

Auctore

Minoru HIRANO

## Sect. **Spinastrum** HIRANO, sect. nov.

*Stauroastrum* subgen. *Schizastrum* TURNER in K. Sv. Vet. Akad. Handl. **25**, 132, 1893 (pro parte)—subgen. *Hectastrum* TURNER l. c. **25**, 133, 1893 (pro parte)—subgen. *Acanthastrum* TURNER l. c. **25**, 133, 1893 (pro parte)—gen. *Staurodesmus* TEILING in Bot. Notis. 76, 1948 (pro parte)

Cellulae non subcylindricae, profunde constrictae, ad angulos solum spina ordinatae cetera glabra, membrana granulata regulariter ordinata.

- 1a. Cellulae cum spina singula ad angulos unoquoque.
- 2a. Isthmo non elongato.
- 3a. Semicellulae ellipticae vel subellipticae.....**St. Dickiei**
- 4a. Cellulae tam longae quam latae.
- 5a. Semicellulae ellipticae, apice convexo.....f. **typica**
- 5b. Semicellulae subsemicirculari-ellipticae, apice valide convexo  
..... var. **circulare**
- 4b. Cellulae leviter latiores quam longiores.....var. **latum**
- 3b. Semicellulae semicirculares vel subsemicirculares vel cyathiformes.
- 4a. Angulis non productis.
- 5a. Marginibus lateralibus valide convexis.
- 6a. Semicellulae cyathiformes.
- 7a. Spinis verticalibus..... **St. apiculatum**
- 7b. Spinis divergentibus.....**St. dejectum** var. **patens**
- 6b. Semicellulae semicirculares.....**St. connatum**
- 5b. Marginibus lateralibus leviter convexis..... var. **rectangulum**
- 4b. Angulis productis.
- 5a. Cellulae in vertice visae cum lateribus concavis, apice semicellularum concavo.
- 6a. Cellulae cum marginibus lateralibus convexis.
- 7a. Cellulae 45  $\mu$  in longitudinem.....var. **pseudoamericanum**
- 7b. Cellulae 24  $\mu$  in longitudinem..... **St. curvatum**
- 6b. Cellulae cum marginibus lateralibus retusis in medio  
..... **St. leptodermum** var. **capitatum**
- 5b. Cellulae in vertice visae cum lateribus convexis, apice semicellularum semicirculari-concavo..... **St. unguiferum**
- 3c. Semicellulae obtriangulares, sinu profundo.

- 4a. Angulis non productis.
  - 5a. Cellulae 35–50  $\mu$  in longitudinem; spinis longis ..... **St. megacanthum**
  - 6a. Apice convexo vel recto, spinis horizontalibus..... f. **typica**
  - 6b. Apice concavo, spinis divergentibus..... var. **scoticum**
  - 5b. Cellulae 18–27  $\mu$  in longitudinem, spinis generaliter brevibus.
    - 6a. Spinis longis..... var. **minus**
    - 6b. Spinis brevibus..... **St. dejectum**
    - 7a. Spinis divergentibus..... f. **typica**
    - 7b. Spinis horizontalibus ..... var. **triangulatum**
- 4b. Angulis productis.
  - 5a. Cellulae biradiatae..... **St. curvatum** f. **biradiata**
  - 5b. Cellulae triradiatae..... **St. aristiferum** var. **indentatum**
- 3d. Semicellulae obtrapeziformes.
  - 4a. Apice convexo..... **St. wandae** var. **brevispinum**
  - 4b. Apice recto vel concavo.
    - 5a. Cellulae in vertice visae cum lateribus convexis ..... **St. erlangense**
    - 5b. Cellulae in vertice visae cum lateribus concavis vel rectis.
      - 6a. Cellulae 32–33  $\mu$  in longitudinem, spinis brevibus  
..... **St. leptodermum** f. **minor**
      - 6b. Cellulae 12–25  $\mu$  in longitudinem.
        - 7a. Cellulae in vertice visae cum lateribus concavis; spinis  
convergentibus..... **St. glabrum**
        - 7b. Cellulae in vertice visae cum lateribus rectis, spinis divergentibus  
vel horizontalibus..... **St. O'Mearii**
        - 8a. Spinis divergentibus ..... f. **typica**
        - 8b. Spinis horizontalibus..... f. **parallela**
- 2b. Isthmo elongato.
  - 3a. Angulis non productis..... **St. cuspidatum**
    - 4a. Spinis rectis, apice convexo.
      - 5a. Spinis convergentibus..... f. **typica**
      - 5b. Spinis divergentibus..... var. **divergens**
    - 4b. Spinis curvatis, apice recto ..... var. **inflexum**
  - 3b. Angulis productis et capitatis..... **St. subscolopacinum**
- 1b. Cellulae cum spinis 2–7 ad angulos unosquoque.
  - 2a. Spinis duabus, mediocriter longis.
    - 3a. Spinis in plano verticali dispositis.
      - 4a. Semicellulae cum angulis apicalibus non productis  
..... **St. longispinum** var. **bidentatum**
      - 4b. Semicellulae cum angulis apicalibus paulo productis et aliquantum  
divergentibus..... **St. ensiferum**
    - 3b. Spinis in plano horizontali dispositis..... **St. bifidum**
  - 2b. Spinis 3–7, brevibus.
    - 3a. Spinis 3 ad angulos ordinatis, apice convexo ..... **St. trifidum**
    - 3b. Spinis 4 ad angulos, apice recto..... **St. quadrangulare**

**Staurastrum Dickiei** RALFS in Brit. Desm. 123, 1848; WOLLE Desm. U. S. 122, 1884; ROY & BISSET Journ. Bot. 24, 238, 1886; MIGULA Krypt. Fl. II, 534, 1907; SMITH Wisc. Bull. 57, 76, 1924; WEST & CARTER Monogr. Brit. Desm. 5, 3, 1923; OKADA Journ. Imp. Fish. Inst.

30, 182, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 189, 1935; PRESCOTT l. c. 25, 91, 1940; WHELDEN Nat. Mus. Canad. Bull. 97, 101, 1947.

Cellulae parvae, circiter tam longiores quam latiores sine spinis, profunde constrictae, sinu aperto acutangulo; semicellulae subellipticae, marginibus dorsalibus et ventralibus aequaliter convexis, angulis lateralibus spinis brevibus praeditis, interius directis; a vertice visae trigonae, lateribus in medio retusis, angulis acute rotundis cum spinis rectis brevibus. Long. 28–34  $\mu$ , Lat. 30–34  $\mu$ , Lat. isth. 7–9  $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Nikuru-numa in Kitami; Toyokoro in Tokachi; Horomui in Ishikari; Tomakomai in Iburi. **Hondo**: Mohara in Kamifusa; Okemi-ike, Kizaki in Shinano; Biwa-ike in Owari; Takashihara in Mikawa; Ariga-ike in Yamashiro. **Kiushiu**: Nakahama of Lake Ikeda in Satsuma; Miyazaki in Hiuga; Ahira in Ōsumi. (Pl. XXXIX, fig. 12)

Distr. Japan, Kuriles, Siberia, India, whole Europe, Nova Zembla, Spitzbergen, Greenland, N. & S. America, Australia, central Africa.

var. **circulare** TURNER in K. Sv. Vet. Akad. Handl. 25, 105, 1893; WEST & CARTER Monogr. Brit. Desm. 5, 5, 1923; KRIEGER Arch. Hydrobiol. suppl. 11, 197, 1932; PRESCOTT Pap. Mich. Acad. Sci. 25, 91, 1940.

Cellulae circulares; semicellulae semicirculares, sinu angusto lineari ad apicem, spinis brevioribus et inflexioribus. Long. 26.6–36.6  $\mu$ , Lat. 28–34  $\mu$ , Lat. isth. 8.4–12  $\mu$ .

Hab. **Hokkaido**: Shimoyûbetsu in Kitami; Horomui, Minenobu in Ishikari; Yûfutsu, Tôasa-numa in Iburi. **Hondo**: Aka-numa in Ugo; Ōishita, Chûkawa-ike, Hakuryu-ko in Uzen; Izu-numa, Kobuchi-numa, Kesho-numa in Rikuzen; Bagyu-numa in Iwaki; Akai in Iwashiro; Oze in Kôzuke; Kurobe-jûdaira in Etchû; Happo-ridge, Inago of Kitamaki-mura in Shinano; Takashihara in Mikawa; Shinohara-ike, Nukigawa in Oomi; Rokujizo, Takaraga-ike in Yamashiro. (New to Japan) (Pl. XXXIX, fig. 11)

Distr. India, Sumatra, Europe, U.S.A., central Africa.

var. **latum** HIRANO, var. nov.

Cellulae latiores quam in forma typica et leviter latiores quam longiores; semicellulae angusto-fusiformes. Long. 32.2  $\mu$ , Lat. sine spin. 39  $\mu$ , Lat. isth. 7.3  $\mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi. (Pl. XXXIX, fig. 13)

**Staurastrum apiculatum** BRÉB. in WEST Trans. Linn. Soc. Bot. 6, 254, 1896; WEST & CARTER Monogr. Brit. Desm. 5, 6, 1923; OKADA Journ. Imp. Fish. Inst. 30, 180, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 186, 1935.

Cellulae parvae, circiter tam longae quam latae, profunde constrictae, sinu aperto acutangulo, extremo rotundato, isthmo leviter elongato; semi-cellulae cyathiformes, apicibus rectis vel leviter convexis, angulis apicalibus rotundis cum spinis brevibus verticalibus, lateralibus ad basim convexis; a vertice visae triangulares, lateribus concavis, angulis rotundis et in singulis spina minuta; membrana glabra. Long. 17–25  $\mu$ , Lat. 17–25  $\mu$ , Lat. isth. 5.6–8  $\mu$ .

Hab. **Hokkaido**: Okineppe in Nemuro; Kiritappu, Akan-junsai-numa in Kushiro; Shimoyûbetsu, Kucharo-ponto, Sarufutsu, Koetoi-konuma in Kitami; Yasuushi in Teshio; Toyokoro in Tokachi; Ukishimahara, Numano-taira of Mt. Daisetsu, Horomui, Nakano near Sapporo, Minenobu in Ishikari; Benten-numa, Tôasa-numa, Numanohata, Yûfutsu, Tomakomai in Iburi; Shizukari, Junsai-numa, Konuma in Oshima. **Hondo**: Nagatai, Mt. Hachimantai in Mutsu; Koke-numa, Nishi-numa, Hirumo-numa, Megata, Aka-numa, Mt. Kurikoma, Kariwano in Ugo; Ôishita, Chûkawa-ike, Hakuryu-ko in Uzen; Kesho-numa, Naga-numa, Izu-numa in Rikuzen; Akaiyachi, Kôriyama, Nogiwano-kwannon-ike in Iwashiro; Bagyu-numa, Ojiroi, Kashima-cho in Iwaki; Oze, Ômine-numa in Kôzuke; Goda-numa in Shimofusa; Mohara, Onjaga-ike in Kamifusa; Kagami-ike near Matsunoyama in Echigo; Sennin-ike in Etchu; Nata-ike near Otari, Shigakôgen, Mt. Kirigamine, Inago of Kitamaki-mura, Kanori-ike, Okemi-ike, Kizaki, Ashinota -ike in Shinano; Tanuki-numa in Suruga; Takashihara, Ônuma in Mikawa; Nukigawa, Shinohara-ike, Fuse-ike in Oomi; Ariga-ike, Takaraga-ike, Mizoroga-ike, Shaku-hachi-ike in Yamashiro. **Shikoku**: Yamanouchi-mura in Sanuki; Matsuyama, Shiramizu-pass in Iyo. **Kiushiu**: Imuta-ike, Nakahama of Lake Ikeda, Nakahara-ike in Satsuma. (Pl. XXXIX, fig. 22)

Distr. Japan, Kuriles, China, Burma, Borneo, Thailand, whole Europe, Greenland, N. America, Australia.

**Staurastrum dejectum** BRÉB. in RALFS Brit. Desm. 121, 1848; De BARY Conj. 50, 1858; WOLLE Desm. U. S. 121, 1884; ROY & BISSET Journ. Bot. 24, 237, 1886; SCHMIDLE Österr. Bot. Ztschr. 45, 30, 1895; WEST & CARTER Monogr. Brit. Desm. 5, 7, 1923; TAYLOR Pap. Mich. Acad. Sci. 20, 189, 1935; PRESCOTT l. c. 25, 91, 1940.

Cellulae parvae, circiter tam longae quam latae, profunde constrictae, sinu late aperto et acutangulo vel paene rectangulari; semicellulae semper triangulares, marginibus lateralibus inferioribus leviter convexis, apice paene recto vel leviter convexo, angulis apicalibus acutis spinis brevibus robustis praeditis, spinis exterius productis; a vertice visae trigonae raro tetragonae, lateribus in parte mediana retusis, angulis acutis et cum spinis rectis brevibus robustis; membrana glabra. Long. sine spin. 19.4–25  $\mu$ , Lat. sine spin. 19.4–30  $\mu$ , Lat. isth. 6.4–11  $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Toyokoro-konuma in Tokachi; Notoro-ponto in Kitami; Kamikoshi-ukishimahara, Numano-taira of Mt. Daisetsu, Nopporo, Minenobu in Ishikari; Benten-numa in Iburi; Shizukari, Junsai-numa in Oshima. **Hondo**: Mt. Hakkoda, Mt. Hachimantai, Kurobo-numa in Mutsu; Futatsuyagata, Megata, Koke-numa, Mt. Kurikoma in Ugo; Mt. Gassan, Mazawano-naga-numa, Ôishita in Uzen; Kesho-numa, Izu-numa, Naga-numa in Rikuzen; Akai, Kôriyama, Mt. Nishi-azumayama in Iwashiro; Kanazuka-mura, Mt. Naeba in Echigo; Oze in Kôzuke; Goda-numa in Shimofusa; Kitaura in Hitachi; Shirouma-ôike, Koshiki-ike of Mt. Kazafuki, Inago of Kitamaki-mura, Mt. Kirigamine in Shinano; Tanuki-numa in Suruga; Takashihara in Mikawa; Biwa-ike in Owari; Toba in Ise; Nukigawa, Fuse-ike in Oomi; Takaraga-ike, Ariga-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Shiramizu-pass near Matsuyama in Iyo. **Kiushiu**: Nakahara-ike near Fukiagenohama in Satsuma; Koshiki-ike of Mt. Kirishima, Miyazaki in Hiuga; Ahira in Ôsumi. (Pl. XXXIX, fig. 20, 23, 24)

Distr. Cosmopolitan.

var. **patens** NORDST. in K. Sv. Vet. Akad. Handl. **22**, 39, 1888; WEST & CARTER Monogr. Brit. Desm. **5**, 9, 1923.

Semicellulae plus angulares, marginibus lateralibus convexis, apice leviter convexo, spinis apicalibus brevibus et divergentibus, sinu acuminato ad verticem. Long. sine spin. 16.8-26.6  $\mu$ , Lat. sine spin. 14-26.6  $\mu$ , Lat. isth. 4.8-7  $\mu$ .

Hab. **Hokkaido**: Okineppe, Onne-numa in Nemuro; Kiritappu in Kushiro; Kucharo-ponto in Kitami. **Hondo**: Mt. Kurikoma in Rikuchu; Gôno-ike in Hitachi; Higusa-numa in Shimofusa; Mohara in Kamifusa; Nata-ike near Otari in Shinano; Jôdo-ike in Ise. (New to Asia) (Pl. XXXIX, fig. 21)

Distr. Europe, Australia, New Zealand, S. America.

var. **triangulatum** KRIEGER in Arch. Hydrobiol. suppl. **11**, 197, 1932.

Semicellulae obverse triangulares, marginibus lateralibus rectis, spinis apicalibus horizontalibus; a vertice visae trigonae, lateribus late retusis. Long. 21.5-26.6  $\mu$ , Lat. sine spin. 23.8-25.8  $\mu$ , Lat. isth. 7.8-8.6  $\mu$ .

Hab. **Hondo**: Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. (New to Japan) (Pl. XXXIX, fig. 25)

Distr. Bali.

**Staurastrum connatum** (LUND.) ROY & BISSET in Journ. Bot. **24**, 237, 1886; WEST & CARTER Monogr. Brit. Desm. **5**, 15, 1923; SMITH Wisc. Bull. **57**, 77, 1924; ALLORGE Rev. Alg. **5**, 364, 1930; SKVORTZOW Philip. Journ. Sci. **49**, 155, 1932. — *Staurastrum defectum* BRÉB. var. *connatum* LUND. in Nov. Act. Regn. Soc. Ups. **3**, VIII, 60, 1871.

Cellulae parvae, longiores quam latae, profunde constrictae, sinu aperto ad extremo acutangulo exterius valide aperto; semicellulae obverse semicirculares, apicibus rectis vel leviter convexis, angulis apicalibus obtusis cum spinis brevibus verticaliter directis; a vertice visae triangulares, lateribus leviter concavis, angulis rotundis cum brevibus spinis. Long. sine spin. 22–24  $\mu$ , Lat. sine spin. 19.6–25  $\mu$ , Lat. isth. 7–9  $\mu$ .

Hab. **Hokkaido**: Sarufutsu, Shimoyûbetsu in Kitami; Horomui in Ishikari; Numanohata in Iburi. **Hondo**: Ôishita in Uzen; Izu-numa in Rikuzen; Akai in Iwashiro; Matsubara-naiko, Fuse-ike in Oomi; Takaraga-ike in Yamashiro. (Pl. XL, fig. 7)

Distr. Japan, central China, Java, Sumatra, Tarkey in Asia, Europe, U. S. A., Australia, New Zealand, Brazil.

*Staurostrum connatum* from Takaraga-ike has a short spine in comparison with the European description and figure given by W. & G. S. WEST.

var. **rectangulum** ROY & BISSET in Journ. Bot. 24, 237, 1886.

Var. marginibus lateralibus cellularum minus convexioribus, sinu paene rectangulari, spinis plus crassioribus. Long. sine spin. 14–20  $\mu$ , cum spin. 33.6  $\mu$ , Lat. sine spin. 14.7–20  $\mu$ , cum spin. 19.6–28  $\mu$ , Lat. isth. 3.5–5.6  $\mu$ .

Hab. **Hondo**: Jôdo-ike in Ise; Fuse-ike in Oomi; Takaraga-ike in Yamashiro. **Kiushiu**: Kagami-ike in Satsuma. (Pl. XL, fig. 9)

Distr. Japan, Sweden, Bornholm.

var. **pseudoamericanum** GRÖNBL. in Act. Soc. Faun. Flor. Fenn. 47, 59, 1920.

Cellulae magnae quam in forma typica, angulis apicalibus productis exterius, apicibus leviter concavis. Long. 39–45  $\mu$ , Lat. sine spin. 25–36.4  $\mu$ , Lat. isth. 5.6–11  $\mu$ .

Hab. **Hondo**: Koke-numa in Ugo; Chûkawa-ike in Uzen; Akai in Iwashiro; Ishigaki-ike in Ise; Mizoroga-ike in Yamashiro. (New to Asia) (Pl. XL, fig. 8)

Distr. Germany, Finland.

*Staurostrum curvatum* WEST in WEST & CARTER Monogr. Brit. Desm. 5, 19, 1923; PORGE Ark. Bot. 23A, 44, 1930.

Cellulae parvae, circiter tam longae quam latae vel leviter longiores quam latiores sine spinis, profunde constrictae, sinu acuto et extrorsum late aperto; semicellulae aliquando lunatae, marginibus lateralibus convexis, apicibus concavis, angulis apicalibus leviter productis et acutis spinis acutis longis

divergentibus instructis; a vertice visae trigonae, lateribus concavis, angulis attenuatis et spina longa instructis; membrana glabra. Long. sine spin.  $22.4\ \mu$ , Lat. sine spin.  $21.7\ \mu$ , Lat. isth.  $4.2\ \mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Shizukari in Oshima. (New to Asia) (Pl. XL, fig. 14)

Distr. Europe.

forma **biradiata** KRIEGER in Arch. Hydrobiol. suppl. **11**, 196, 1932.

Cellulae in vertice visae biradiatae. Long. sine spin.  $16.8\ \mu$ , cum spin.  $22.4\ \mu$ , Lat. sine spin.  $16.8\ \mu$ , cum spin.  $19.6\ \mu$ , Lat. isth.  $7\ \mu$ .

Hab. **Hondo**: Fuse-ike in Oomi. (New to Asia) (Pl. XL, fig. 15)

Distr. Sumatra.

**Staurastrum leptodermum** LUND. forma **minor** LÜTKEM. in Ann. k. k. Nat. Hist. Hofm. **15**, 123, 1900.

Cellulae minores quam in forma typica. Long.  $29.4\text{--}36\ \mu$ , Lat. sine spin.  $28\text{--}33.6\ \mu$ , Lat. isth.  $14\ \mu$ .

Hab. **Hokkaido**: Shimoyûbetsu in Kitami; Toyokoro in Tokachi; Horomui in Ishikari; Yûfutsu in Iburi; Shizukari in Oshima. **Hondo**: Chûkawa-ike in Uzen; Nogiwano-kwannon-ike in Iwashiro; Kizaki in Shinano; Takashihara in Mikawa; Biwa-ike in Owari; Ishigaki-ike, Tamaru in Ise; Lake Biwa, Fuse-ike in Oomi. **Kiushiu**: Ahira in Ôsumi. (New to Japan) (Pl. XXXIX, fig. 17)

Distr. Central China.

var. **capitatum** HIRANO in Act. Phytotax. Geobot. **15**, 59, 1953.

Cellulae obsemicirculares, apicibus valide concavis, marginibus lateralibus prominente biundulatis, angulis apicalibus prominente productis; in vertice visae trigonae, lateribus rectis, angulis capitatis. Long. sine spin.  $68.8\ \mu$ , Lat. sine spin.  $40.7\ \mu$ , Lat. isth.  $17.2\ \mu$ .

Hab. **Hondo**: Lake Biwa in Oomi. (Pl. XL, fig. 1)

Distr. Japan.

**Staurastrum unguiferum** TURNER in K. Sv. Vet. Akad. Handl. **25**, 130, 1893.

Cellulae modicae, circiter  $1\frac{1}{2}\text{--}1\frac{3}{4}$  longiores quam latae, modice constrictae, sinu late aperto et paene rectangulari ad verticem; semicellulae subquadrato-cuneatae, marginibus lateralibus convexis, apicibus late excavatis, angulis apicalibus acutis spinis brevibus robustis ornatis; a vertice visae trigonae, lateribus leviter convexis, angulis rotundis. Long. sine spin.  $50.4\ \mu$ , Lat. sine spin.  $30.8\ \mu$ , Lat. isth.  $15.4\ \mu$ .



Hab. **Hondo**: Fuse-ike in Oomi. (New to Japan) (Pl. XXXIX, fig. 10)  
Distr. India.

**Staurastrum megacanthum** LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 61, 1871; WOLLE Desm. U. S. 121, 1884; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 47, 69, 1920; WEST & CARTER Monogr. Brit. Desm. 5, 20, 1923; SMITH Wisc. Bull. 57, 75, 1924; OKADA Journ. Imp. Fish. Inst. 30, 185, 1934.

Cellulae modicae, circiter tam longae quam latae sine spinis, profundissime constrictae, sinu aperto et acutangulo; semicellulae subtriangulares, marginibus lateralibus et apicibus convexis, angulis apicalibus aliquantulum acutis spinis longis robustis ornatis, spinis horizontalibus aliquando leviter convergentibus vel divergentibus; a vertice visae triangulares, lateribus retusis, angulis acute rotundis spinis ornatis. Long. 35–39  $\mu$ , Lat. sine spin. 36.4–39.3  $\mu$ , Lat. isth. 7–11.2  $\mu$ .

Hab. **Hokkaido**: Toyokoro in Tokachi. **Hondo**: Chûkawa-ike in Uzen; Fuse-ike in Oomi. (New to Japan) (Pl. XXXIX, fig. 14)

Distr. India, whole Europe, Faeroes, Iceland, N. America, Patagonia.

Our form of *Staurastrum megacanthum* is generally smaller than the European form.

Var. **scoticum** W. & G. S. WEST in Journ. Linn. Soc. Bot. 35, 544, 1903; WEST & CARTER Monogr. Brit. Desm. 5, 21, 1923; SMITH Wisc. Bull. 57, 76, 1924.

Var. apicibus rectis vel leviter concavis, lateribus leviter convexis, spinis longioribus et divergentibus. Long. sine spin. 34.4–35.3  $\mu$ , Lat. sine spin. 37.6–38.7  $\mu$ , Lat. isth. 10.8  $\mu$ .

Hab. **Hondo**: Kotsutsumi-nishi-ike in Mikawa; Fuse-ike in Oomi. (Pl. XXXIX, fig. 15)

Distr. British Isles, Scandinavia, N. America.

var. **minus** HIRANO in Mem. Coll. Sci. Univ. Kyoto, B, 19, 68, 1948.

Semicellulae parvae, circiter dimidiores quam in forma typica. Long. sine spin. 23.7  $\mu$ , Lat. sine spin. 23.7  $\mu$ , Lat. isth. 6.5  $\mu$ , Long. spin. 13.8  $\mu$ .

Hab. **Hondo**: Mizoroga-ike in Yamashiro. (Pl. XXXIX, fig. 16)

Distr. Japan.

**Staurastrum aristiferum** RALFS var. **indentatum** SMITH in Wisc. Bull. 57, 72, 1924; HIRANO Jap. Journ. Bot. 14, 229, 1954.

Semicellulae raro parviores quam in forma typica, spinis subparallelis et leviter divergentibus; a vertice visae trigonae, lateribus concavis cum acuminata spina in medio inter angulos. Long. sine spin. 18.3  $\mu$ , cum spin. 28  $\mu$ , Lat. sine spin. 18.2  $\mu$ , cum spin. 30  $\mu$ , Lat. isth. 8.4  $\mu$ .

Hab. **Hondo**: Mt. Hakkoda in Mutsu; Ayame-daira of Oze in Kôzuke.  
(Pl. XXXIX, fig. 26)

Distr. Japan, U.S.A.

**Staurastrum wandae** RACIB. var. **brevispinum** GRÖNBL. in Bot. Notis. 63, 1938;  
HIRANO Act. Phytotax. Geobot. 14, 171, 1952.

Cellulae compressae, spinis brevioribus, similibus ut in forma typica. Long. sine spin. 22.4–24  $\mu$ , Lat. sine spin. 17.6–23  $\mu$ , Lat. isth. 11–14.6  $\mu$ .

Hab. **Hokkaido**: Mt. Daisetsu, Kamikoshi-ukishimahara in Ishikari. **Hondo**: Mt. Hachimantai in Rikuchu; Mt. Gassan in Uzen; Mt. Azuma in Iwashiro; Oze in Kôzuke; Mt. Naeba in Echigo; Mt. Tateyama in Etchu; Shigakôgen, Mt. Kazafuki, Tsuga-daira, Kamino-tanbo in Shinano. (Pl. XXXIX, fig. 18)

Distr. Japan, Finland.

**Staurastrum erlangense** REINSCH in MIGULA Krypt. Fl. II, 536, 1907.

Cellulae parvae, leviter longiores quam latiores, modice constrictae, sinu late aperto; semicellulae obverse subtrapeziformes, marginibus lateralibus leviter convexis, apice recto, angulis apicalibus obtusis cum spinis brevibus; a vertice visae triangulares, lateribus convexis, angulis obtusis cum brevibus spinis. Long. 25.8  $\mu$ , Lat. 19.4  $\mu$ , Lat. isth. 16  $\mu$ .

Hab. **Hondo**: Ko-ike in Yamashiro. (New to Asia) (Pl. XL, fig. 10)

Distr. France, Germany.

**Staurastrum glabrum** (EHRENB.)RALFS in Brit. Desm. 217, 1848; WEST & CARTER Monogr. Brit. Desm. 5, 2, 1923; WHELDEN Nat. Mus. Canad. Bull. 97, 103, 1947; HIRANO Act. Phytotax. Geobot. 14, 170, 1952.

Cellulae parvae, paene tam longae quam latae, modice constrictae, sinu aperto paene rectangulari; semicellulae cuneatae vel subtriangulares, marginibus ventralibus rectis, apice recto vel leviter concavo, angulis apicalibus cum spinis longis, validis et inflexis; a vertice visae trigonae vel 4-gonae, lateribus concavis, angulis acutis cum spinis longis rectis; membrana glabra. Long. 18–22.4  $\mu$ , Lat. sine spin. 16.8–22.4  $\mu$ , Lat. isth. 6.3–9.6  $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Komukai-ponto, Sarufutsu in Kitami; Horomui, Kamikoshi-ukishimahara in Ishikari; Yûfutsu in Iburi; Shizukari in Oshima. **Hondo**: Ôyachi of Mt. Hachimantai in Rikuchu; Koke-numa in Ugo; Mt. Gassan, Ôishita in Uzen; Oze in Kôzuke; Mt. Naeba in Echigo; Mt. Kirigamine in Shinano; Kotsutsumi-nishi-ike in Mikawa; Matsubara-naiko in Oomi. (Pl. XXXIX, fig. 19)

Distr. Japan, Asia Minor, Europe, N. America, Africa.

**Staurastrum O'Mearii** ARCH. in WEST & CARTER Monogr. Brit. Desm. 5, 13, 1923;

HIRANO Act. Phytotax. Geobot. **14**, 171, 1952.

Cellulae parvae, leviter longiores quam latiores sine spinis, modice constrictae, sinu aperto rectangulo; semicellulae triangulares, apicibus et marginibus lateralibus leviter convexis, angulis apicalibus obtusis cum spinis longis robustis leviter alte directis; a vertice visae trigonae, lateribus paene rectis vel leviter convexis, angulis obtusis cum spinis longis. Long. sine spin. 14–22.4  $\mu$ , Lat. sine spin. 14–21.5  $\mu$ , Lat. isth. 8.6–13  $\mu$ .

Hab. **Hokkaido**: Kamikoshi-ukishimahara in Ishikari. **Hondo**: Mt. Azuma in Uzen; Mt. Tateyama in Etchu; Happo-ridge, Tengunohara, Tsuga-daira, Mt. Kazafuki in Shinano. (Pl. XL, fig. 4)

Distr. Japan, Europe, N. America.

forma **parallela** STRÖM in Skrift Utg. Norsk. Vid. Akad. Oslo math.-nat. **6**, 237, 1926; HIRANO Act. Phytotax. Geobot. **14**, 171, 1952.

Forma spinis parallelis vel leviter convergentibus, sinu profundiore. Long. 19.6  $\mu$ . Lat. sine spin. 16.8  $\mu$ , Lat. isth. 7.6  $\mu$ .

Hab. **Hondo**: Mt. Gassan, Azuma in Uzen; Mt. Tateyama in Etchu; Shigakôgen in Shinano. (Pl. XL, fig. 5, 6)

Distr. Japan, Norway.

**Staurastrum cuspidatum** BRÉB. in RALFS Brit. Desm. 122, 1848; WOLLE Desm. U. S. 123, 1884; MIGULA Krypt. Fl. II, 535, 1907; WEST & CARTER Monogr. Brit. Desm. **5**, 23, 1923; KAISER Krypt. Forsch. **1**, 440, 1926; SKVORTZOW Arch. Hydrobiol. **19**, 168, 1928; ALLORGE Rev. Alg. **5**, 364, 1930; KRIEGER Arch. Hydrobiol. suppl. **11**, 196, 1932; OKADA Journ. Imp. Fish. Inst. **30**, 181, 1934; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. **3**, 435, 1936.

Cellulae parvae, circiter  $1\frac{1}{2}$  longiores quam latiores, profundissime constrictae, sinu aperto et rectangulari ad apicem rotundato, isthmo leviter elongato; semicellulae obverse subtriangulares, apicibus et lateribus leviter convexis, angulis apicalibus spinis longis convergentibus ornatis; a vertice visae triangulares, lateribus concavis, angulis bene rotundis. Long. sine spin. 19.6–25.8  $\mu$ , Lat. sine spin. 15.4–22.4  $\mu$ , Lat. isth. 4.2–7  $\mu$ .

Hab. **Hokkaido**: Onne-numa, Chôbushi-numa in Nemuro; Kiritappu in Kushiro; Noto-ro-ponto in Kitami; Toyokoro-konuma in Tokachi; Tomakomai, Benten-numa, Tôasa-numa, Yûfutsu in Iburi; Shizukari, Konuma in Oshima. **Hondo**: Naga-numa in Rikuzen; Chûkawa-ike in Uzen; Nogiwanokwannon-ike in Iwaki; Akai in Iwashiro; Matsunoyama-ôike in Echigo; Okemi-ike in Shinano; Ishigaki-ike in Ise. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XL, fig. 12)

Distr. Japan, Siberia, Burma, Ceylon, Java, Abyssinia, whole Europe, Faeroes, Greenland, N. America, Brazil, Australia, New Zealand, central Africa, Nova Scotia.

var. **divergens** NORDST. in WEST Journ. Roy. Micr. Soc. 157, 1896; WEST & CARTER Monogr. Brit. Desm. 5, 25, 1923; ALLORGE Rev. Alg. 5, 364, 1930; KRIEGER Arch. Hydrobiol. suppl. 11, 197, 1932.

Cellulae minores, sinu aliquantulum acuminato ad verticem, spinis divergentibus. Long. sine spin.  $25.3\ \mu$ , Lat. sine spin.  $16.8\ \mu$ , Lat. isth.  $4.8\ \mu$ .

Hab. **Hondo**: Kanori-ike in Shinano; Ikejiri-ike in Tanba. (New to Japan) (Pl. XL, fig. 11)

Distr. Burma, Java, Bali, Europe, Paraguay.

var. **inflexum** RACIB. in Wydz. Akad. Um. Krakow 10, 27, 1889 (reprint); MIGULA Krypt. Fl. II, 535, 1907,

Var. spinis longioribus et robustioribus, valide inflexis; in vertice visae spinis curvatis (ut in *S. cyrtocero*) aliquando irregularibus. Long. sine spin.  $25.3\ \mu$ , Lat. sine spin.  $23.8\ \mu$ , Lat. isth.  $5.6\ \mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro. (New to Asia) (Pl. XL, fig. 13)

Distr. Europe.

**Staurastrum subscolopacinum** W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 276, 1896.

Cellulae parvae, circiter tam longae quam latae sine spinis, profunde constrictae, sinu semicirculari aperto et paene rectangulari, isthmo leviter elongato; semicellulae late cuneatae vel triangulares, marginibus lateralibus paene rectis vel leviter convexis, apice recto, angulis apicalibus leviter rotundis spinis longis rectis ornatis, spinis directis interius; a vertice visae trigonae, lateribus subrectis, angulis leviter productis et cum spinis longis. Long.  $16.8-25\ \mu$ , Lat. sine spin.  $16.8-24\ \mu$ , cum spin.  $28-31\ \mu$ , Lat. isth.  $3.6-5\ \mu$ .

Hab. **Hondo**: Kamaga-ike of Mt. Kirigamine in Shinano; Jôdo-ike in Ise. (New to Asia) (Pl. XL, fig. 20)

Distr. U. S. A.

**Staurastrum longispinum** (BAIL.) ARCH. var. **bidentatum** (WITTR.) WEST in WEST & CARTER Monogr. Brit. Desm. 5, 34, 1923; TAYLOR Pap. Mich. Acad. Sci. 20, 193, 1935; PRESCOTT l. c. 21, 141, 1936. — *Staurastrum bidentatum* WITTR. in Nov. Act. Soc. Ups. 3, VII, 16, 1869.

Var. similis formae typicae, raro minor, apicibus in vertice visis paene rectis, spinis non brevibus. Long.  $31-62\ \mu$ , Lat. sine spin.  $37-64.5\ \mu$ , Lat. isth.  $11-26.5\ \mu$ .

Hab. **Hondo**: Ôishita in Uzen; Ozegahara in Kôzuke; Kotsutsumi-nishi-ike in Mikawa; Jôdo-ike in Ise; Fuse-ike in Oomi; Mizoroga-ike, Takaraga-ike in Yamashiro. (Pl. XL, fig. 3, 18)

Distr. Japan, India, Australia, Europe, N. America.

*Staurostrum longispinum* var. *bidentatum* in Japan is much smaller than the British dimension given by W. & G. S. WEST

**Staurostrum ensiferum** TURNER in K. Sv. Vet. Akad. Handl. 25, 109, 1893; WEST Trans. Linn. Soc. Bot. 6, 176, 1902.

Cellulae mediocres, circiter tam longae quam latae vel leviter latiores, profunde constrictae, sinu acute aperto ad verticem acuminato; semicellulae triangulares, marginibus lateralibus convexis et leviter inflatis, apicibus paene rectis vel leviter convexis, angulis apicalibus leviter alte productis cum binis spinis longis robustis verticaliter ornatis; a vertice visae triangulares, lateribus late retusis, angulis acute rotundis cum spinis longis robustis ornatis. Long. 31–42  $\mu$ , cum spin. 56  $\mu$ , Lat. sine spin. 30–39  $\mu$ , cum spin. 45  $\mu$ , Lat. isth. 11–13  $\mu$ .

Hab. **Hokkaido**: Shimoyûbetsu in Kitami; Horomui in Ishikari. **Hondo**: Biwa-ike in Owari; Ishigaki-ike in Ise. (New to Japan) (Pl. XL, fig. 19)

Distr. India, Ceylon.

**Staurostrum bifidum** (EHRENB.) BRÉB. in RALFS Brit. Desm. 215, 1848; LUNDELL Nov. Act. Regn. Soc. Ups. 3, VIII, 62, 1871; ROY & BISSET Journ. Bot. 24, 238, 1886; WEST & CARTER Monogr. Brit. Desm. 5, 32, 1923.

Cellulae raro parvae, circiter tam longae quam latae sine spina, profunde constrictae, sinu aperto et subrectangulari; semicellulae subellipticae vel subtriangulares, marginibus lateralibus inferioribus paullo convexis et marginibus superioribus plus convexioribus, angulis lateralibus cum spinis binis longis validis convergentibus in eadem plane praeditis; a vertice visae triangulares, lateribus concavis, angulis bifidis et cum spinis acutis longis utrumque; membrana fine punctata. Long. 32–42  $\mu$ , Lat. sine spin. 34–39  $\mu$ , cum spin. 53  $\mu$ , Lat. isth. 11–16.7  $\mu$ .

Hab. **Hokkaido**: Shimoyûbetsu in Kitami; Horomui in Ishikari. **Hondo**: Ozegahara in Kôzuke; Hakuryu-ko, Chûkawa-ike in Uzen; Akai in Iwashiro; Izu-numa in Rikuzen; Fuse-ike in Oomi. (Pl. XL, fig. 2)

Distr. Japan, central China, Thailand, Burma, India, Ceylon, Java, whole Europe.

**Staurostrum trifidum** NORDST. in Vidensk. Medd. Naturh. For. Kôhvn. 226, 1887. — var. *reversa* TURNER in K. Sv. Vet. Akad. Handl. 25, 108, 1893.

Cellulae submediocres, leviter tam longae quam latae, profunde constrictae, sinu acute aperto et leviter acuminato; semicellulae obverse subtriangulares, marginibus lateralibus convexis et tumidis, apicibus convexis, angulis apicalibus rotundis cum spinis tribus ornatis; a vertice visae triangulares, lateri-

bus paullo convexis, angulis rotundis cum spinis tribus ornatis quorum duo ad angulos, unius intra angulos. Long. sine spin.  $39\ \mu$ , Lat. sine spin.  $35\ \mu$ , Lat. isth.  $11\ \mu$ .

Hab. **Hondo**: Ishigaki-ike in Ise. (New to Japan) (Pl. XL, fig. 16)

Distr. India, Brazil, U.S.A.

*Staurastrum trifidum* from Ishigaki-pond is somewhat different from Brazilian original description by having a more convex apex and lateral margin and also in vertical view the side is slightly convex. TURNER has recorded an Indian form under the name of var. *reversa* but his figure is similar to the NORDSTEDT'S original figure and this form has a slightly retuse side in vertical view.

**Staurastrum quadrangulare** BRÉB. in RALFS Brit. Desm. 128, 1848; ROY & BISSET Journ. Bot. 24, 238, 1886; BÖRGESEN Bot. Tidskr. 17, 151, 1890; WEST Trans. Linn. Soc. Bot. 5, 257, 1896; WEST & CARTER Monogr. Brit. Desm. 5, 37, 1923; DONAT Pflanzenf. 5, 21, 1926; SKVORTZOW Philip. Journ. Sci. 49, 155, 1932.

Cellulae parvae, subrectangulares, leviter longiores quam latiores, profunde constrictae, sinu aperto acutangolo; semicellulae rectangulares, marginibus ventralibus leviter convexis, apicibus rectis, angulis cum spinis quaternis divergentibus; a vertice visae quadrangulares, lateribus concavis, angulis leviter productis et rotundis cum duabus spinis geminatis; membrana dense punctata. Long. sine spin.  $25-27\ \mu$ , cum spin.  $30-31\ \mu$ , Lat. sine spin.  $22.4-29.4\ \mu$ , cum spin.  $26-32\ \mu$ , Lat. isth.  $9.8-11\ \mu$ .

Hab. **Hokkaido**: Shimoyûbetsu, Notoro-ponto in Kitami; Horomui, Mine-nobu in Ishikari; Yûfutsu, Tôasa-numa, Tomakomai, Benten-numa in Iburi; Shizukari, Konuma in Oshima. **Hondo**: Komozuchi in Mutsu; Nishi-numa in Ugo; Chûkawa-ike in Uzen; Akaiyachi, Kôriyama in Iwashiro; Nanko in Iwaki; Oze-numa in Kôzuke; Okemi-ike in Shinano; Biwa-ike in Owari; Nukigawa, Fuse-ike in Oomi. (Pl. XL, fig. 17)

Distr. Japan, Korea, Manchuria, whole Europe, Bornholm, Brazil.

#### Sect. **Granuliformes** HIRANO, sect. nov.

Cellulae non subcylindricae, profunde constrictae, ad angulos solum spina ordinatae cetera glabrae, membrana granulata regulariter ordinata.

- 1a. Cellulae cum spinis singulis ad angulum unumquodque; semicellulae obsemicirculares..... **St. lunatum**
- 1b. Cellulae cum spinis 2-3 ad angulum unumquodque.
  - 2a. Semicellulae subellipticae vel fusiformes.
  - 3a. Cellulae cum serie 2-3 evidente granulorum ad angulos, granulis prope angulos finitimis..... **St. denticulatum**

- 3b. Cellulae cum serie numerosis granulorum.....**St. avicula**
- 2b. Semicellulae obverse semicirculares vel subtriangulares.
- 3a. Semicellulae subtriangulares.
  - 4a. Cellulae 22–29  $\mu$  in longitudinem..... var. **subarcuatum**
  - 4b. Cellulae 38–40  $\mu$  in longitudinem..... **St. pileatum** var. **inflatum**
- 3b. Semicellulae subsemicirculares, angulis leviter productis....**St. subcruciatum**
- 2c. Semicellulae obtrapeziformes, cellulae 45–48  $\mu$  in longitudinem
  - .....**St. pseudobiretum**

**Staurastrum lunatum** RALFS in Brit. Desm. 124, 1848; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 47, 69, 1920; WEST & CARTER Monogr. Brit. Desm. 5, 29, 1923; PRESCOTT Pap. Mich. Acad. Sci. 25, 92, 1940.

Cellulae raro parvae, circiter tam longae quam latae sine spinis, profunde constrictae, sinu aperto et acutangulo ad verticem; semicellulae obverse semicirculares vel subtriangulares, marginibus lateralibus convexis, apicibus rectis cum angulis apicalibus obtusis et spinis brevibus robustis oblique directis ornatis; membrana aspere granulata, granulis in serie concentrica ad angulos ornatis; a vertice visae triangulares, lateribus leviter concavis, angulis leviter productis et cum spinis brevibus robustis, granulis in serie concentrica ad angulos, sed aspere et irregulariter prope centrum, centro glabro. Long. 25–47  $\mu$ , Lat. 26–50  $\mu$ , Lat. isth. 8–11  $\mu$ .

**Hab. Hokkaido:** Okineppe, Onne-numa in Nemuro; Kiritappu in Kushiro; Shimoyûbetsu, Nikuru-numa in Kitami; Horomui, Minenobu in Ishikari; Shizukari in Oshima. **Hondo:** Ôishita, Chûkawa-ike, Hakuryu-ko in Uzen; Akai in Iwashiro; Bagyu-numa in Iwaki; Gôno-ike, Kitaura in Hitachi; Mohara in Kamifusa; Goda-numa in Shimofusa; Ôike near Matsunoyama in Echigo; Kamikôchi, Okemi-ike in Shinano; Ikejiri-ike in Tanba. **Shikoku:** Matsuyama in Iyo. (New to Japan) (Pl. XL, fig. 24)

Distr. Manchuria, Siberia, whole Europe, Greenland, N. America, Azores.

**Staurastrum denticulatum** (NÄG.) ARCH. in WEST Journ. Roy. Micr. Soc. 6, 292, 1890; WEST & CARTER Monogr. Brit. Desm. 5, 38, 1923. — *Phycastrum denticulatum* NÄG. in Gatt. einz. Alg. 128, 1849.

Cellulae parvae, tam longae quam latae, profunde constrictae, sinu aperto acutangulo; semicellulae subellipticae vel fusiformes, marginibus ventralibus convexis, marginibus dorsalibus leviter convexis, angulis lateralibus acute rotundis, spinis duabus minutis praeditis; a vertice visae trigonae, lateribus concavis, angulis obtuse rotundis; membrana granulata, granulis in seriebus concentricis tribus ad angulos, centro semicellularum glabro. Long. 32–38.7  $\mu$ , Lat. 30.8–38.6  $\mu$ , Lat. isth. 11–17  $\mu$ .

**Hab. Hondo:** Ozegahara in Kôzuke; Mt. Naeba in Echigo; Inago of Kitamaki-mura in Shinano; Nukigawa in Oomi. (New to Asia) (Pl. XL, fig. 21)

Distr. Whole Europe, Faeroes, Australia, central Africa, Azores, S. America.

**Staurastrum avicula** BRÉB. in RALFS Brit. Desm. 140, 1848; WOLLE Desm. U. S. 123, 1884; ROY & BISSET Journ. Bot. 24, 238, 1886; G. S. WEST Journ. Bot. 37, 25, 1899; MIGULA Krypt. Fl. II, 537, 1907; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 47, 57, 1920; WEST & CARTER Monogr. Brit. Desm. 5, 40, 1923; Smith Wisc. Bull. 57, 71, 1924; PRESCOTT Pap. Mich. Acad. Sci. 25, 90, 1940; WHELDEN Nat. Mus. Canad. Bull. 97, 97, 1947.

Cellulae parvae, circiter tam longae quam latae, profunde constrictae, sinu late aperto ad apicem acutangulo; semicellulae subellipticae vel subtriangulares, lateralibus inferioribus paene rectis vel leviter convexis, lateralibus superioribus convexis, angulis lateralibus paullo productis in processibus brevibus cum spinis tribus brevibus, et cum granulis in seriebus concentricis circa angulos et annulis transversis granulorum supra isthmum semicellularum; a vertice visae trigonae, lateribus paene rectis vel leviter concavis, angulis acute rotundis, prope angulos granulis in seriebus concentricis et ad centrum irregulariter et sparsim dispositis. Long. 21–26  $\mu$ , Lat. 22.4–25.8  $\mu$ , Lat. isth. 7–8.6  $\mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu; Moritake-ôtsutsumi in Ugo; Izu-numa, Kobuchi-numa in Rikuzen; Oze-ôegawa in Kôzuke; Kurosawano-ike of Mt. Myôko in Echigo; Kamikôchi, Shigakôgen in Shinano. (Pl. XLI, fig. 5)

Distr. Japan, whole Europe, Faeroes, Greenland, N. America, Brazil.

*Staurastrum avicula* in our country is somewhat smaller than the British dimension given by WEST & CARTER and has a transverse serie of punctations just above the isthmus.

var. **subarcuatum** (WOLLE) WEST in WEST & CARTER Monogr. Brit. Desm. 5, 41, 1923; DICK Krypt. Forsch. 1, 451, 1926; TAFT Ohio Journ. Sci. 45, 202, 1945. — *Staurastrum subarcuatum* WOLLE in Desm. U. S. 140, 1884.

Semicellulae angustiores quam in forma typica, obverse trigonae, plus profunde constrictae, angulis apicalibus plus productis, granulis specialibus; lateribus in vertice visis plus concavis, angulis angustioribus et leviter productis. Long. 21–31  $\mu$ , Lat. 19.6–31  $\mu$ , Lat. isth. 7–11  $\mu$ .

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi; Tomakomai in Iburi. **Hondo**: Numano-taira of Mt. Bandai in Iwashiro; Mt. Kirigamine in Shinano; Toba in Ise. **Shikoku**: Shiramizu-pass near Matsuyama in Iyo. **Kiushiu**: Imuta-ike in Satsuma; Mt. Ôhatayama of Kirishima in Hiuga. (New to Japan) (Pl. XL, fig. 25)

Distr. India, Europe, U. S. A., Australia.



**Staurastrum pileatum** DELP. var. **inflatum** MASKELL in Trans. & Proc. New Zeal. Inst. 21, 24, 1888.

Cellulae mediocres, circiter  $1\frac{1}{2}$  longiores quam latae, profunde constrictae, sinu aperto acutangulo; semicellulae obverse trapeziformes, marginibus lateralibus leviter convexis, apicibus rectis, angulis apicalibus rotundis cum duabus spinis brevibus robustis verticaliter dispositis; a vertice visae triangulares, lateribus leviter concavis, angulis acute rotundis et cum spinis brevibus; membrana granulata, granulis in seriebus concentricis ad angulos ornatis, centro apicis semicellularum glabro. Long.  $33.6-39\mu$ , Lat.  $33.6-47.6\mu$ , Lat. isth.  $12.6-16.8\mu$ .

Hab. **Hondo**: Inago of Kitamaki-mura in Shinano; Ariga-ike in Yamashiro. (New to Asia) (Pl. XLI, fig. 1)

Distr. New Zealand.

**Staurastrum subcruciatum** COOKE & WILLS in MIGULA Krypt. Fl. II, 549, 1907; WEST & CARTER Monogr. Brit. Desm. 5, 42, 1923.

Cellulae mediocres, quarte parte latiores quam longiores, profunde constrictae, sinu aperto acutangulo; semicellulae subtriangulares, marginibus lateralibus leviter convexis, apice paene recto, angulis apicalibus leviter productis et sursum curvatis cum apicibus truncatis et verticaliter spinis binis longis robustis ornatis; membrana granulata, granulis in seriebus concentricis ad angulos; a vertice visae quadrangulares, lateribus concavis, angulis leviter productis et cum spinis robustis terminalibus. Long.  $34-45\mu$ , Lat. sine spin.  $45-48\mu$ , Lat. isth.  $11-13\mu$ .

Hab. **Hondo**: Myojin-ike of Kamikôchi in Shinano; Shinohara-ike, Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. (New to Asia) (Pl. XL, fig. 22, 23)

Distr. Europe.

**Staurastrum pseudobiretum** PLAYFAIR in Proc. Linn. Soc. New South Wales 32, 183, 1907.

Cellulae modicae, circiter tam longae quam latae vel leviter latiores quam longiores, profunde constrictae, sinu angusto-lineari ad extremum vel acuminato; semicellulae obtrapeziformes, angulis basalibus obtusis, marginibus lateralibus leviter convexis et divergentibus, angulis apicalibus rotundis spinis parvis duabus verticaliter instructis, apicibus paene rectis vel paullulo convexis; membrana granulata, granulis in serie concentricis circa 5 ad angulos instructis; a vertice visae trigonae, lateribus concavis, angulis leviter inflatis et spinis parvis instructis, granulis in serie concentricis ad angulos instructis. Long.  $45\mu$ , Lat.  $50.4\mu$ , Lat. isth.  $22.4\mu$ .

Hab. **Hondo**: Tamaru in Ise. (New to Asia) (Pl. XLI, fig. 16)

Distr. Australia.

Sect. **Raphidiastrum** TURNER emend. HIRANO

*Stauroastrum* subgen. *Raphidiastrum* TURNER in K. Sv. Vet. Akad. Handl. 25, 133, 1893.

Cellulae non subcylindricae, profunde constrictae, membrana tota spinulata, spinis numerosis regulariter vel irregulariter ordinatis.

- 1a. Cellulae cum spinis paucis, aliquantum finitimis prope angulos vel duriter sparsis.
- 2a. Semicellulae ellipticae, subfusiformes vel subpyramidatae, spinis aliquantum in serie radiali ad angulos ordinatis.
- 3a. Cellulae parvae, 19-24  $\mu$  in longitudinem, spinis brevibus.
- 4a. Semicellulae elliptico-rectangulares, marginibus lateralibus cum spinis tribus duriter ordinatis ..... **St. Hystrix**
- 4b. Semicellulae elliptico-fusiformes vel elliptico-subpyramidatae.
- 5a. Cellulae in vertice visae cum serie dorsali denticulorum intra marginem unumquemque.
- 6a. Cellulae in vertice visae cum spinis 6 in ambitu marginis lateralis uniuscuiusque, spinis mediocriter longis.
- 7a. Apice semicellularum cum spinis longis in partes duas ordinato ..... **St. Simonyi**
- 7b. Semicellulae cum spinis aequaliter longis ordinatae ..... var. **sparse-aculeatum**
- 6b. Cellulae in vertice visae cum spinis minutis 8 in ambitu marginis lateralis uniuscuiusque ..... **St. echinatum**
- 6c. Cellulae in vertice visae cum spinis binatis 4 in ambitu marginis lateralis uniuscuiusque ..... **St. gurgeliense**
- 5b. Cellulae in vertice visae cum serie dorsalibus prominentibus spinarum et spinis duabus aliis in ambitu marginis uniuscuiusque ..... **St. subheteroplophorum** var. **minor**
- 3b. Cellulae 33-37  $\mu$  in longitudinem, spinis longis praesertim longis ad et prope angulos ..... **St. subteliferum**
- 2b. Semicellulae obtrapeziformes, cellulae 35-42  $\mu$  in longitudinem.
- 3a. Cellulae spinis brevibus ad angulos apicales ordinatae, in vertice visae cum tribus spinis in serie transversali contra angulos ..... **St. cristatum**
- 4a. Cellulae 35-40  $\mu$  in longitudinem, in vertice visae lateribus rectis sine serie granulorum ..... f. **typica**
- 4b. Cellulae 50-56  $\mu$  in longitudinem, in vertice visae lateribus retusis, cum serie granulorum ad angulos ..... var. **japonicum**
- 3b. Cellulae spinis longis apicalibus, in vertice visae cum singulis spinis intra angulos ordinatae ..... **St. subdisparatum**
- 1b. Cellulae cum spinis numerosis in tota facie semicellularum.
- 2a. Semicellulae ellipticae vel subellipticae, angulis non productis.
- 3a. Cellulae cum angulis lateralibus latis.
- 4a. Cellulae 32-50  $\mu$  in longitudinem.
- 5a. Semicellulae ellipticae, spinis robustis ..... **St. teliferum**
- 5b. Semicellulae elliptico-reniformes vel truncato-subpyramidatae, spinis gracilis.
- 6a. Spinis brevibus ..... **St. hirsutum**

- 6b. Spinis longis.....**St. gladiosum**  
 4b. Cellulae 50-70  $\mu$  in longitudinem, semicellulae ellipticae vel subellipticae, spinis robustis et longis..... **St. polystichum**  
 3b. Cellulae cum angulis lateralibus subacutis, spinis brevibus et gracilibus.....**St. pilosum**  
 2b. Semicellulae aliquantum cyathiformes, angulis paullo productis et recurvatis ad sursum.....**St. erasum**

**Staurastrum Hystrix** RALFS in Brit. Desm. 128, 1848; WOLLE Desm. U. S. 142, 1884; WEST & CARTER Monogr. Brit. Desm. 5, 60, 1923; HOMFELD Pflanzenf. 12, 76, 1929; ALLORGE Rev. Alg. 5, 365, 1930; OKADA Journ. Imp. Fish. Inst. 30, 184, 1934.

Cellulae parvae, leviter longiores quam latiores sine spinis, profunde constrictae, sinu aperto acutangulo; semicellulae elliptico-rectangulares, marginibus dorsalibus leviter convexis, marginibus lateralibus leviter truncato-rotundis cum tribus spinis sparsis; cellulae cum 6-8 spinis brevibus ordinatae; a vertice visae generaliter triangulares, raro quadrangulares, lateribus leviter concavis, angulis late rotundis cum tribus spinis, ad angulos (una ad apicem, alterae duo prope angulos), et ad marginem lateralem ordinatis, apice glabro. Long. sine spin. 21-25  $\mu$ , Lat. sine spin. 18.3-24  $\mu$ , Lat. isth. 6-9  $\mu$ .

Hab. **Hokkaido**: Mt. Daisetsu, Kamikoshi-ukishimahara in Ishikari. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu; Mt. Kurikoma, Koke-numa in Ugo; Mt. Gassan, Mt. Azuma in Uzen; Ozegahara in Kôzuke; Kurosawano-ike of Mt. Myoko, Mt. Naeba in Echigo; Gakino-tanbo, Sennin-ike, Mt. Tateyama, Kumono-taira, Tarôbei-daira, Kurobegoro-daira in Etchû; Happo-ridge, Shirouma-ôike, Tengenohara, Tsuga-daira, Mt. Kazafuki, Shigakôgen in Shinano; Mt. Hira, Oku-ike of Higashi-kusano-mura in Oomi; Mizoroga-ike in Yamashiro; Ikejiri-ike in Tanba. (Pl. XLI, fig. 7)

Distr. Japan, Kuriles, whole Europe, U.S.A.

**Staurastrum Simonyi** HEIMERL in BORGE Ark. Bot. 6, 48, 1906; WEST & CARTER Monogr. Brit. Desm. 5, 45, 1923; OKADA Bot. Mag. 59, 433, 1936.

Cellulae parvae, circiter longiores quam latiores vel leviter longiores quam latiores sine spinis, profunde constrictae, sinu aperto et acutangulo; semicellulae ellipticae vel subfusiformes vel subpyramidatae, marginibus ventralibus et dorsalibus aequaliter convexis, angulis lateralibus truncatis et duabus spinis verticaliter praeditis, apicibus semicellularum spinis quaternis praeditis (in parte mediana duae mediocriter longiores et projectibus erecta); a vertice visae 3-4-gonae, lateribus rectis vel leviter concavis et leviter undulatis cum spinis quaternis brevibus im ambitu marginis et etiam quaternis intra marginem (duabus medianis conspicuis), angulis obtuse rotundis spinis bi- vel 4 praeditis. Long. 19-24  $\mu$ , Lat. sine spin. 18-25  $\mu$ , Lat. isth. 6-7.5  $\mu$ .

Hab. **Hokkaido**: Tôro in Kushiro; Mt. Daisetsu, Kamikoshi-ukishimahara

in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu. Koke-numa, Mt. Komagatake in Ugo; Mt. Azuma, Mt. Gassan in Uzen; Mt. Kurikoma in Rikuchû; Mt. Numano-taira of Mt. Bandai in Iwashiro; Oze in Kôzuke; Senjôgahara, Usagishima in Shimotsuke; Kurosawano-ike, Koyano-ike of Mt. Myoko, Mt. Naeba in Echigo; Gakino-tanbo, Sennin-ike, Kumono-taira, Kurobegoro-daira, Mt. Kaminotake, Mt. Tateyama in Etchû; Shigakôgen, Midoriga-ike of Mt. Yatsugatake, Mt. Kirigamine, Happo-ridge, Kazafuki-ôike, Tengunohara, Shirouma-ôike, Tsuga-daira, Mt. Sanpôgamine, Karuizawa in Shinano; Mt. Hira in Oomi. **Kiushiu**: Yabakei in Bunzen. (Pl. XLI, fig. 9)

Distr. Japan, Europe, N. America.

var. **sparse-aculeatum** (SCHMIDLE) HIRANO in Bot. Mag. 66, 208, 1953.—*Staurastrum sparseaculeatum* SCHMIDLE in Österr. Bot. Ztschr. 31, 1895; SCHRÖDER Forsch. Biol. Stat. Plön 6, 41, 1898; DICK Bot. Arch. 3, 228, 1923.

Var. spinis regulariter acutioribus. Long. sine spin. 19.6–23.7  $\mu$ , Lat. sine spin. 19.6–19.8  $\mu$ , Lat. isth. 5.6–7.7  $\mu$ .

Hab. **Hondo**: Tarobei-daira in Etchû. (Pl. XLI, fig. 17, 24)

Distr. Germany, Switzerland.

**Staurastrum echinatum** BRÉB. in WEST Bot. Tidskr. 24, 177, 1901; BERGE Bot. Notis. 49, 1913; WEST & CARTER Monogr. Brit. Desm. 5, 56, 1923.

Cellulae parvae, tam longae quam latae, profunde constrictae, sinu aperto et acutangolo; semicellulae elliptico-fusiformes, dorso quam ventre convexiore, angulis lateralibus subtruncate rotundis, apicibus convexis; membrana minute spinata, spinis verticaliter dispositis trans semicellulam; a vertice visae trigonae, lateribus paene rectis, spinis (circa 8 in latere et etiam intra marginem spinis duabus a polo ad polum, in centro glabris, angulis truncato-rotundis. Long. 23.7  $\mu$ , Lat. 23.7  $\mu$ , Lat. isth. 10.8  $\mu$ .

Hab. **Hondo**: Mt. Eboshi in Etchû. (New to Japan) (Pl. XLI, fig. 18, 19)

Distr. Tailand, whole Europe, Greenland, N. America, Africa.

**Staurastrum gurgeliense** SCHMIDLE in Österr. Bot. Ztschr. 35, 1896 (reprint); MIGULA Krypt. Fl. II, 542, 1907.

Cellulae parvae, circiter tam longae quam latae, profunde constrictae, sinu acuto et aperto; semicellulae oblongae, angulis leviter productis et spinis 2–3 instructis, apicibus paulo convexis serie spinis emarginatis instructis, corporis semicellularum cum serie transversali spinarum de angulo ad angulos; a vertice visae trigonae, lateribus paene rectis undulatis serie marginali spinarum instructis, basibus spinarum paulo productis, serie denticulorum juxta intra marginem unumquemque instructis, angulis truncatis trispinatis. Long. sine spin. 21.5  $\mu$ , Lat. sine spin. 21.5  $\mu$ , Lat. isth. 10  $\mu$ .

Hab. **Hondo**: Tanuki-numa in Suruga. (New to Asia) (Pl. XLI, fig. 6, 8)  
Distr. Austria.

**Staurastrum subheteroplophorum** (GRÖNBLAD) HIRANO var. **minor** HIRANO  
var. nov.

*Staurastrum forficulatum* LUND. var. *subheteroplophorum* GRÖNBL. in Act. Soc. Faun. Flor. Fenn. 49, 57, 1921; MESSIKOMMER Viertelj. Naturf. Ges. Zürich 73, 208, 1928.

Cellulae parvae, circiter tam longae quam latae vel leviter latiores quam longiores sine spinis, profunde constrictae, sinu aperto acuminato; semicellulae ellipticae vel subellipticae, marginibus dorsalibus convexioribus quam ventralibus, angulis lateralibus spinis duabus divergentibus in plano verticali instructis, apicibus convexis spinis prominentibus et spinis similaribus intra angulos laterales utrobique ordinatos instructis; a vertice visae trigonae, lateribus paene rectis 3-undulato-retusis, spinis duabus erectis equidistantibus de angulo ad angulos et spinis duabus similaribus intra marginem unumquemque instructis, angulis acutis spina singula instructis. Var. cellulae dimidiores quam forma typica. Long. sine spin.  $15\mu$ , cum spin.  $17\mu$ , Lat. sine spin.  $15.5\mu$ , cum spin.  $19.5\mu$ , Lat. isth.  $5.6\mu$ .

Hab. **Hondo**: Ukishima-ônuma in Uzen. (Pl. XLI, fig. 25, 26)

**Staurastrum subtiliferum** ROY & BISSET in Journ. Bot. 24, 238, 1886.

Cellulae parvae, leviter longiores quam latiores sine spinis, profunde constrictae, sinu acute aperto; semicellulae ellipticae; membrana spinulata, spinis tribus superlongis ad angulos; a vertice visae trigonae, lateribus valide retusis in medio, angulis conicis acutis cum spinis singulis superlongis ad angulos, seriebus singulis spinarum prope angulos praeditis (spinis duabus lateralibus superlongis), annulis spinarum (circiter 9) prope centrum praeditis; centro glabro. Long. sine spin.  $33.6\mu$ , Lat. sine spin.  $30.8\mu$ , Lat. isth.  $11.2\mu$ .

Hab. **Hokkaido**: Okineppe, Onne-numa in Nemuro. (Pl. XLI, fig. 15)

Distr. Japan.

**Staurastrum cristatum** (NÄG.) ARCH. in RABENHORST Flor. Europ. Alg. III, 215, 1868; ROY & BISSET Journ. Bot. 24, 239, 1886; WEST Journ. Linn. Soc. Bot. 29, 173, 1892; MIGULA Krypt. Fl. II, 538, 1907; KAISER Krypt. Forsch. 1, 227, 1919; WEST & CARTER Monogr. Brit. Desm. 5, 47, 1923; AILORGE Rev. Alg. 5, 364, 1930; WHELDEN Nat. Mus. Canad. Bull. 97, 100, 1947.

Cellulae modicae, longiores quam latiores, modice constrictae, sinu acuto et aperto ad verticem aliquando angusto-lineari; semicellulae elliptico-subreniformes, marginibus lateralibus inferioribus longioribus quam superioribus et divergentibus, angulis lateralibus obtuse rotundis vel leviter mamillatis

cum brevibus spinis exterius directis, et spinis duabus brevibus intra marginem lateralem superiorem prope angulos invisibiles; a vertice visae trigonae, lateribus paene rectis, angulis acute rotundis cum spinis brevibus, et cum duobus spinis ad angulos intra marginem. Long. 34-45  $\mu$ , Lat. 34-47.6  $\mu$ , Lat. isth. 16.8-22.4  $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Shimoyûbetsu in Kitami; Horomui, Nakano near Sapporo in Ishikari; Shizukari in Oshima. **Hondo**: Inago of Kitamaki-mura in Shinano; Ikejiri in Tanba. (Pl. XLI, fig. 2)

Distr. Japan, Siberia, India, Turkey in Asia, Europe, Faeroes, Spitzbergen, Greenland, Arctic Canada.

var. **japonicum** HIRANO in Act. Phytotax. Geobot. 14, 71, 1951.

Cellulae latiores quam longiores; semicellulae obverse subtrapeziformes, angulis apicalibus spinis duabus inaequalibus verticaliter dispositis, superioribus longioribus; in vertice visae trigonae, lateribus retusis, intra angulum unumquemque seriebus quaternis spinis et seriebus duabus concentricis punctulorum separatim ad angulos. Long. 50-56  $\mu$ , Lat. sine spin. 59-64  $\mu$ , Lat. isth. 19-21  $\mu$ .

Hab. **Hondo**: Lake Biwa in Oomi. **Hokkaido**: Moseushi in Ishikari. (Pl. XLI, fig. 4)

Distr. Japan.

**Staurastrum subdisparatum** HIRANO, sp. nov.

Cellulae submediocres, leviter longiores quam latiores sine spinis, profunde constrictae, sinu acuminato ad extremum; semicellulae obverse subtrapeziformes, marginibus ventralibus convexis, apice truncato in parte mediana leviter elevato cum spinis duabus longis juxta infra elevationem utrobique, spinis obliqualiter directis, angulis apicalibus leviter productis et acutis spinis longis robustis divergentibus ordinatis; a vertice visae trigonae, lateribus paene rectis vel leviter concavis, angulis inflatis et obtusis spinis rectis longis ordinatis, spinis duabus sublongis intra angulum unumquemque. Long. sine spin. 34.4  $\mu$ , Lat. sine spin. 32.3  $\mu$ , Lat. isth. 13  $\mu$ .

Hab. **Hondo**: Kotsutsumi-nishi-ike in Mikawa. (Pl. XLI, fig. 21, 22)

**Staurastrum teliferum** RALFS in Brit. Desm. 128, 1848; ROY & BISSET Journ. Bot. 24, 238, 1886; WEST & CARTER Monogr. Brit. Desm. 5, 58, 1923; ALLORGE Rev. Alg. 5, 367, 1930; OKADA Journ. Imp. Fish. Inst. 30, 190, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 198, 1935; PRESCOTT & SCOTT Trans. Amer. Micr. Soc. 61, 24, 1942.

Cellulae submediocres, circiter longiores quam latiores, profunde constrictae, sinu aperto acutangulo; semicellulae ellipticae, angulis lateralibus

late rotundis; cellulis cum spinis brevibus et robustis in 2-3 series transversas trans semicellulam productis; a vertice visae triangulares, lateribus rectis vel leviter concavis, angulis late rotundis; spinis affluentibus ad angulos sed paucis prope apices. Long. sine spin. 31-42  $\mu$ , Lat. sine spin. 28-39  $\mu$ , Lat. isth. 11-16  $\mu$ .

**Hab. Hokkaido**: Onne-numa in Nemuro; Akan-junsai-numa, Kiritappu in Kushiro; Nikuru-numa, Shimoyûbetsu, Komukai-ponto in Kitami; Shikaribetsu-wopputo, Toyokoro in Tokachi; Nakano near Sapporo, Horomui, Minenobu, Hisago-numa of Mt. Daisetsu in Ishikari; Yûfutsu, Benten-numa, Tôasa-numa, Numanohata, Tomakomai in Iburi; Shizukari, Junsai-akanuma, Konuma in Oshima. **Hondo**: Megata in Ugo; Izu-numa, Naga-numa, Kesho-numa in Rikuzen; Ôishita, Chûkawa-ike, Hakuryu-ko in Uzen; Bagyu-numa, Kashima-cho in Iwaki; Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Oze in Kôzuke; Kagami-ike of Matsunoyama in Echigo; Inago of Kitamaki-mura, Mt. Kirigamine, Kizaki in Shinano; Tanuki-numa in Suruga; Kotsutsuminishi-ike, Suhara-ike, Takashihara in Mikawa; Biwa-ike in Owari; Ishigaki-ike, Jôdo-ike in Ise; Fuse-ike, Shinohara-ike in Oomi; Mizoroga-ike, Takaraga-ike in Yamashiro. **Kiushiu**: Imuta-ike in Satsuma; Miyazaki in Hiuga; Ahira in Ôsumi. (Pl. XLI, fig. 14)

Distr. Japan, Europe, U.S.A.

*Staurastrum teliferum* is allied to *St. hirsutum* and other spinous forms, but is distinguished from the former by the less number of spines and perfectly elliptical semicell and from the latter by smaller size of semicell and less spination. In *St. teliferum* about two series of spines are visible on the face of semicell while in *St. hirsutum* about four series are visible and spines are relatively small and delicate. *St. teliferum* is widely distributed on ponds and marshes of mountains or lowland and is sometimes found on the *sphagnum* moor pools in the subalpine region while *St. hirsutum* is common on the moors or pools in the alpine or subalpine regions.

**Staurastrum hirsutum** (EHRENB.) BRÉB. in RALFS Brit. Desm. 127, 1848; WOLLE Desm. U. S. 141, 1884; MIGULA Krypt. Fl. II, 532, 1907; WEST & CARTER Monogr. Brit. Desm. 5, 65, 1923; OKADA Bot. Mag. 50, 433, 1936.

Cellulae parvae, circiter  $1\frac{1}{2}$  longiores quam latiores, profunde constrictae, sinu aperto et acutangulo; semicellulae elliptico-subpyramidatae vel semicirculari-subfusiformes, generaliter latissimae prope basim, angulis bene rotundis; membrana spinulata, spinis brevibus et in seriebus transversis trans semicellulam (verticaliter 5); a vertice visae triangulares, lateribus paene rectis vel leviter concavis, angulis rotundis, spinis in seriebus concentricis prope angulos ordinatis, apicibus semicellularum glabris. Long. sine spin. 31-47  $\mu$ , Lat. sine

spin. 31-47  $\mu$ , Lat. isth. 11-15  $\mu$ .

Hab. **Hokkaido**: Mt. Daisetsu, Horomui, Nakano near Sapporo in Ishikari. **Hondo**: Mt. Hachimantai, Mt. Kurikoma, Mt. Iwate in Rikuchu; Mt. Komagatake, Hirumo-numa in Ugo; Mt. Gassan, Hakuryu-ko in Uzen; Mt. Nishiazuma in Iwashiro; Ozegahara in Kôzuke; Gôno-ike in Hitachi; Mt. Naeba, Kôyono-ike of Mt. Myoko in Echigo; Sennin-ike, Gakino-tanbo, Mt. Yakushi, Mt. Tateyama, Tsuruga-ike, Ôniu-ike of Mt. Norikura, Mt. Mitsumata-rengé in Etchû; Happo-ridge, Shirouma-ôike, Mt. Kazafuki, Kamikôchi, Mt. Sanpôgamine, Okemi-ike in Shinano; Matsubara-naiko in Oomi. (Pl. XLI, fig. 11, 12)

Distr. Japan, Manchuria, whole Europe, Spitzbergen, Greenland, Faeroes, N. & S. America.

**Staurastrum gladiosum** TURNER in WEST & CARTER Monogr. Brit. Desm. 5, 57, 1923; KRIEGER Arch. Hydrobiol. suppl. 11, 199, 1932; PRESCOTT Pap. Mich. Acad. Sci. 25, 92, 1940.

Cellulae submediocres, leviter longiores quam latiores sine spinis, profunde constrictae, sinu acuto aperto; semicellulae ellipticae; membrana spinulata, spinis pilosis in seriebus regularibus ordinatis, seriebus tribus transversalibus trans semicellulam visibilis; a vertice visae triangulares, lateribus leviter retusis, angulis late rotundis, spinis aliquantulum in seriebus concentricis ad angulos sed duriter ad centrum ordinatis. Long. sine spin. 39  $\mu$ , Lat. sine spin. 33.6  $\mu$ , Lat. isth. 12.6  $\mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. (New to Japan) (Pl. XLI, fig. 13)  
Distr. China, Sumatra, Europe, U.S.A.

**Staurastrum polystichum** (PERTY) RABENH. in LUNDELL Nov. Act. Regn. Soc. Ups. 3, VIII, 63, 1871; MIGULA Krypt. Fl. II, 532, 1907; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 47, 74, 1920; WEST & CARTER Monogr. Brit. Desm. 5, 53, 1923; OKADA ASAHINA's Inkwa. 185, 1939.

Cellulae mediocriter magnae, leviter longiores quam latiores sine spinis, profunde constrictae, sinu aperto et acutangulo; semicellulae ellipticae; membrana spinulata, spinis longis robustis et numerosis in seriebus concentricis ad angulos ordinatis; a vertice visae triangulares, lateribus paene rectis aliquantulum leviter concavis, angulis obtuse rotundis, spinis in seriebus concentricis ad angulos ordinatis, spinis relative brevibus ad centrum, in centro semicellularum glabris. Long. sine spin. 70  $\mu$ , Lat. sine spin. 64.4  $\mu$ , Lat. isth. 19.6  $\mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi. (New to Japan) (Pl. XLI, fig. 23)  
Distr. Kuriles, China, India, whole Europe, N. America, Argentine.

**Staurastrum pilosum** (NÄG.) ARCH. in WITTROCK Nov. Act. Soc. Ups. 3, 17, 1869;



WEST & CARTER Monogr. Brit. Desm. 5, 63, 1923; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. U. R. S. S. Pl. Crypt. 1, 45, 1933; OKADA Journ. Imp. Fish. Inst. 30, 187, 1934.

Cellulae submediocres, circiter tam longae quam latae vel leviter longiores sine spinis, profunde constrictae, sinu aperto acutangulo; semicellulae subellipticae vel subfusiformes, marginibus dorsalibus et ventralibus aequaliter convexis, angulis lateralibus nonnihil acute rotundis; membrana spinulata, spinis numerosis brevibus in serie transversis sparsis trans semicellulas (circa 6-7 seriebus); a vertice visae trigonae, lateribus leviter concavis, angulis rotundis spinis in seriebus concentricis ad angulos ornatis, centro glabro. Long. sine spin. 36.4-49  $\mu$ , Lat. sine spin. 37.6-45  $\mu$ , Lat. isth. 12-13.6  $\mu$ .

Hab. **Hokkaido**: Okineppe, Onne-numa in Nemuro. **Hondo**: Mt. Hakkoda in Mutsu; Ôegawa of Oze in Kôzuke; Kumono-taira in Etchû. (New to Japan) (Pl. XLI, fig. 3)

Distr. Kuriles, Siberia, whole Europe, Faeroes, Iceland, Spitzbergen, Greenland, U.S.A.

**Staurastrum erasum** BRÉB. in RABENHORST Flor. Europ. Alg. III, 212, 1868; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 47, 62, 1920; WEST & CARTER Monogr. Brit. Desm. 5, 71, 1923; HOMFELD Pflanzenf. 12, 74, 1929.

Cellulae modicae, circiter tam longae quam latae, profunde constrictae, sinu aperto acutangulo; semicellulae subellipticae vel nonnihil cyathiformes, marginibus lateralibus leviter convexis, apice convexo in medio, angulis apicalibus rotundis leviter productis oblique exterius; membrana apiculata, apiculis brevibus et in seriebus aparsis concentricis prope angulos praeditis; a vertice visae triangulares, lateribus concavis, angulis rotundis, centro glabro. Long. 47  $\mu$ , Lat. 47  $\mu$ , Lat. isth. 16  $\mu$ .

Hab. **Hokkaido**: Kiritappu, Tokotan in Kushiro; Shimoyûbetsu in Kitami; Yasuushi in Teshio; Moseushi, Horomui in Ishikari; Numanohata, Tomakomai in Iburi; Shizukari in Oshima. **Hondo**: Kariwano, Nishi-numa in Ugo; Hakuryu-ko, Ôishita in Uzen; Kobuchi-numa in Rikuzen; Akai-yachi in Iwashiro; Higusa-numa in Shimofusa; Ôike near Matsunoyama in Echigo; Mt. Eboshi in Etchû; Myojin-ike of Kamikôchi in Shinano; Takashihara, Ônuma in Mikawa; Biwa-ike in Owari; Nukigawa in Oomi; Ikejiri-ike in Tanba. **Shikoku**: Dôgo near Matsuyama in Iyo. (New to Japan) (Pl. XLI, fig. 10)

Distr. Siberia, Europe.

#### Sect. **Aciculiformes** HIRANO, sect. nov.

Cellulae non subcylindricae, profunde constrictae, ad angulos solum verrucis ordinatae.

- 1a. Cellulae cum serie ventralium processuum ..... St **aciculiferum**  
 1b. Cellulae cum serie dorsalium processuum.....St. **subaciculiferum**

**Staurostrum aciculiferum** (WEST) ANDERS. in WEST & CARTER Monogr. Brit. Desm 5, 171, 1923.

Cellulae parvae, leviter longiores quam latiores sine spinis, profunde constrictae, sinu aperto acutangulo; semicellulae obverse subtriangulares, marginibus lateralibus leviter convexis, angulis apicalibus obtusis cum spinis longis robustis, spinis aliquando ornatis in processus crassos bifidos, apicibus semicellularum convexis et leviter retusis in medio; membrana cum granulis minutis in serie concentrica versa ad angulos; a vertice visae trigonae, lateribus paene rectis et retusis in medio, angulis obtusis spinis robustis aliquando bifidis in apice ornatis, granulis ornatis in seriebus concentricis sed ad angulos irregularibus prope centrum. Long. 22.4-25  $\mu$ , Lat. sine spin. 19.6-22.4  $\mu$ , cum spin. 28  $\mu$ , Lat. isth. 7.8-9  $\mu$ .

Hab. **Hondo**: Mt. Hakkoda in Mutsu; Kurosawano-ike of Mt. Myoko in Echigo. (Pl. XLI, fig. 20)

Distr. Europe, U.S.A.

**Staurostrum subaciculiferum** HIRANO, sp. nov.

Cellulae parvae, circiter tam longae quam latae vel paullo latiores cum processibus, profunde constrictae, sinu aperto acutangulo; semicellulae subellipticae vel obverse subtriangulares, marginibus superioribus et inferioribus convexis, angulis apicalibus in processus breves solidos productis, apicibus processuum nonnumquam bifurcatis, apicibus semicellularum latis et convexis, sparsim granulatis, granulis in annulis concentricis circa angulos ornatis; a vertice visae 3-4-gonae, lateribus mediocriter retusis in medio, prope angulis inflatis et in processus solidos productis, sparsim granulatis, granulis in annulis concentricis circa angulos et irregulariter in centrum. Long. sine proc. 26  $\mu$ , cum proc. 29  $\mu$ , Lat. sine proc. 26  $\mu$ , cum proc. 38.8  $\mu$ , Lat. isth. 11  $\mu$ .

Hab. **Hondo**: Ito-dake in Uzen; Kumono-taira in Etchû. (Pl. XLII, fig. 18)

#### Sect. **Rutidiastrum** TURNER emend. HIRANO

*Staurostrum* subgen. *Rutidiastrum* TURNER in K. Sv. Vet. Akad. Handl. 25, 133, 1893.

Cellulae non subcylindricae, profunde constrictae, ad angulos et ad apicem verrucis ordinatae, seriebus dorsalibus verrucarum interdum reductis in emarginato-bispinas parvas.

- 1a. Semicellulae ellipticae vel subellipticae.  
 2a. Apice semicellularum glabro, angulis lateralibus spinis prominentibus in versus

- deorsum directis ordinatis..... **St. oxyrhynchum**
- 2b. Apice semicellularum verrucoso.
- 3a. Cellulae in vertice visae cum marginibus undulatis, angulis spinis prominentibus ordinatis..... subsp. **truncatum**
- 3b. Cellulae in vertice visae cum marginibus verrucosis, angulis spinis minutis tribus..... **St. mutilatum**
- 1b. Semicellulae trapeziformes.
- 2a. Cellulae cum serie emarginatorum processuum..... **St. spongiosum**
- 3a. Sinu angusto-lineari ad extremum, lateribus in vertice visis paullo convexis..... f. **typica**
- 3b. Sinu acuto ad extremum, lateribus in vertice visis paullo concavis..... var. **Griffithianum**
- 2b. Cellulae cum serie emarginatorum verrucarum ..... **St. scabrum**

**Staurastrum oxyrhynchum** ROY & BISSET in Journ. Bot. 24, 238, 1886.

Cellulae parvae, circiter longiores quam latiores, profunde constrictae, sinu acute aperto; semicellulae subellipticae, marginibus lateralibus superioribus convexioribus quam inferioribus, angulis lateralibus subtruncatis cum spinis prominentis deorsum directis, apicibus convexis verrucalibus emarginatis praeditis; a vertice visae triangulares, lateribus rectis vel leviter concavis, angulis rotundis cum seriebus granulorum emarginatorum subrectorum intra marginem, in centro glabra. Long. 25–36  $\mu$ , Lat. 25–34  $\mu$ , Lat. isth. 8.4–11  $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Toyokoro-konuma in Tokachi; Horomui in Ishikari; Tomakomai, Yûfutsu, Tôasa-numa, Benten-numa in Iburi. **Hondo**: Ôishita in Uzen; Izu-numa in Rikuzen; Akaiyachi in Iwashiro; Bagyu-numa in Iwaki; Ishigaki-ike in Ise; Shinohara-ike in Oomi. (Pl. XLII, fig. 11)

Distr. Japan.

subsp. **truncatum** LÜTKEM. in Ver. k.k. Zool. Bot. Ges. Wien 499, 1910.

Semicellulae in fronte visae ellipticae cum apicibus verrucosis, angulis lateralibus truncatis cum spinis duabus horizontaliter directis; a vertice visae trigonae, lateribus rectis et undulatis, cum seriebus duabus granulorum a margine ad marginem (series interna curva et granulis ornata, series externa granulis paucioribus ornata). Long. 30–31  $\mu$ , Lat. 29  $\mu$ , Lat. isth. 11  $\mu$ .

Hab. **Hondo**: Fuse-ike in Oomi. (New to Asia) (Pl. XLII, fig. 14, 21)

Distr. Germany.

**Staurastrum mutilatum** LUNDELL in Nov. Act. Regn. Soc. Ups. ser. 3, VIII, 74, 1871.

Cellulae subparvae, circiter  $1\frac{1}{2}$  longiores quam latae, modice constrictae, sinu aperto acuto vel rectangulari; semicellulae subhexagonales, marginibus lateralibus superioribus et inferioribus paene rectis, apicibus convexo-truncatis;

membrana cum seriebus horizontalibus verrucarum trans semicellulas; a vertice visae triangulares, lateribus paene rectis cum 4 verrucae in medio marginis et seriebus granulorum emarginatorum intra marginem, angulis obtuse rotundis cum granulis acutis ad angulos apicesque, centro glabro. Long.  $45\ \mu$ , Lat.  $34\ \mu$ , Lat. isth.  $22.4\ \mu$ .

Hab. **Hondo**: Tsuruga-ike of Mt. Norikura in Etchû. (New to Asia) (Pl. XLII, fig. 7)

Distr. Sweden.

**Staurastrum spongiosum** BRÉB. in RALFS Brit. Desm. 141, 1848; WEST Journ. Roy. Micr. Soc. 6, 1889; MIGULA Krypt. Fl. II, 531, 1907; SCHULZ Bot. Arch. 2, 144, 1922; WEST & CARTER Monogr. Brit. Desm. 5, 76, 1923; KRIEGER Hedw. 70, 145, 1930.

Cellulae mediocres, circiter tam longae quam latae vel leviter longiores, profunde constrictae, sinu angusto-lineari ad apicem et exterius aperto; semicellulae subsemicirculares vel subpyramidatae, angulis basalibus obtusis, apicibus convexis cum processibus emarginatis (circa 8-10) ad marginem et etiam processibus 6 horizontaliter trans semicellulas, a vertice visae triangulares, lateribus paene rectis cum 6 processibus emarginatis in ambitu marginis et etiam processibus tribus intra marginem basis processus uniuscuiusque, processibus diminutis ad angulos, angulis productis in processus breves et cum spinis tribus ad apicem, centro apicis semicellulae glabro. Long. cum proc.  $56-58\ \mu$ , Lat. cum proc.  $51-56\ \mu$ , Lat. isth.  $19-20\ \mu$ .

Hab. **Hokkaido**: Chôboshi-numa in Nemuro; Kiritappu, Tôro in Kushiro; Tomakomai in Iburi. **Hondo**: Akai in Iwashiro; Ozegahara, Mt. Akagi in Kôzuke; Kôyano-ike of Mt. Myoko in Echigo; Inago of Kitamaki-mura, Lake Kizaki, Happo-ridge in Shinano; Mt. Hichimenzan in Kai; Kanashôzu in Ise; Fuse-ike in Oomi. (Pl. XLII, fig. 5)

Distr. Japan, Siberia, whole Europe, Spitzbergen, Greenland, N. America, Argentine.

var. **Griffithianum** (NÄG.) LAGERH. in WEST & CARTER Monogr. Brit. Desm. 5, 78, 1923; HIRANO Act. Phytotax. Geobot. 12, 162, 1943.

Var. sinu apertiore; lateribus in vertice visis paene rectis vel leviter concavis, in medio leviter rotundatis et concavis inter processus centrales. Long.  $42\ \mu$ , Lat.  $36.4\ \mu$ , Lat. isth.  $8.4\ \mu$ .

Hab. **Hokkaido**: Yûfutsu in Iburi; Shizukari in Oshima. **Hondo**: Kashima-cho in Iwaki; Mt. Kirigamine in Shinano; Mt. Hira in Oomi. (Pl. XLII, fig. 8)

Distr. Japan, Europe, Spitzbergen, Greenland, Sandwhich Isles.

**Staurastrum scabrum** BRÉB. in RALFS Brit. Desm. 214, 1848; WOLLE Desm. U. S. 130, 1884; WEST Trans. Roy. Irish Acad. 32, 51, 1902; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 57, 1921; WEST & CARTER Monogr. Brit. Desm. 5, 81, 1923; OKADA Journ. Imp. Fish. Inst. 30, 188, 1934.

Cellulae parvae, circiter longiores quam latiores, profunde constrictae, sinu aperto acutangulo; semicellulae elliptico-fusiformes vel subpyramidato-truncatae, in parte dorsali quam ventrali convexiores, angulis lateralibus rotundis circiter tribus granulis acutis ornatis; membrana granulata, granulis in 8 seriebus transversis trans semicellulam (series mediana cum 6 geminatis et ceteri ad angulos); a vertice visae trigonae, lateribus leviter concavis cum 6 granulis emarginatis et granulis in duabus seriebus intra marginem, granulis rotundis et cum spinis ad angulos. Long. 27–36  $\mu$ , Lat. 25–34  $\mu$ , Lat. isth. 8.4–11  $\mu$ .

Hab. **Hokkaido**: Numano-taira of Mt. Daisetsu in Ishikari. **Hondo**: Mt. Hakkoda, Mt. Hachimantai, Mt. Iwaki in Mutsu; Mt. Kurikoma in Ugo; Mt. Gassan, Mt. Sugigamine of Zawo in Uzen; Oze in Kôzuke; Mt. Naeba, Kurosawano-ike, Kôyano-ike of Mt. Myoko in Echigo; Mt. Tateyama in Etchû; Shigakôgen, Tengenohara, Shirouma-ôike, Tsuga-daira in Shinano. (Pl. XLII, fig. 15)

Distr. Japan, Kuriles, whole Europe, Faeroes, Greenland, U.S.A., Azores.

#### Sect. **Stellatiformes** HIRANO, sect. nov.

Cellulae ad angulos in processus productae, processibus apicalibus glabris non denticulo vel granulo in toto margine longitudinis ordinatis sed extrematibus processuum glabris vel spinatis.

- 1a. Cellulae processibus ad angulos ordinatae.
- 2a. Processibus non solidis.
- 3a. Cellulae serie dorsalium processuum ordinatae.
- 4a. Cellulae in vertice visae cum processibus duobus dorsalibus ad marginem lateralem unumquemque.
- 5a. Angulis semicellularum glabris.
- 6a. Spinis apicalibus in plano horizontali dispositis; cellulae in vertice visae cum angulis latis..... **St. monticulosum** var. **bidens**
- 6b. spinis apicalibus in plano verticali dispositis; cellulae in vertice visae cum angulis acutis..... **St. furcatum**
- 7a. Cellulae sine serie verticali spinarum.
- 8a. Cellulae in vertice visae cum processibus dorsalibus non prope angulos dispositae..... **f. typica**
- 8b. Cellulae in vertice visae cum processibus dorsalibus prope angulos dispositae..... forma **spinosa**
- 7b. Cellulae cum serie ventrali spinarum..... var. **subsenarium**
- 5b. Angulis semicellularum cum serie radiali granulorum..... **St. subavicula**

- 4b. Cellulae in vertice visae cum processibus quaternis dorsalibus ad marginem lateralem unumquemque.....**St. submonticulosum**
- 3b. Cellulae serie dorsali et ventrali processuum ordinatae.
- 4a. Cellulae parvae, circa  $30\mu$  in longitudinem sine processibus....**St. senarum**
- 5a. Cellulae cum serie ventrali processuum.
- 6a. Angulis semicellularum glabris..... f. **typica**
- 6b. Angulis semicellularum cum serie radialibus granulorum  
.....var. **nigrae-silvae**
- 5b. Cellulae cum serie ventrali spinarum.....var. **simplex**
- 4b. Cellulae modicae, circa  $48\mu$  in longitudinem sine processibus  
.....**St. forficulatum**
- 5a. Cellulae in vertice visae cum lateribus concavis, processibus dorsalibus bispinatis ad extremum..... f. **typica**
- 5b. Cellulae in vertice visae cum lateribus rectis, processibus dorsalibus generaliter trispinatis.....var. **verrucosum**
- 2b. Processibus solidis bifurcatis..... **St. subbörgesenii**
- 1b. Cellulae cum processibus duobus ad angulos solum.....**St. gemelliparum**

**Staurationum monticulosum** BRÉB. var. **bidens** W. & G. S. WEST in Journ. Linn. Soc. Bot. 38, 126, 1907.

Semicellulae subrectangulares, angulis basalibus et apicalibus spinis binis ornatis, sine annularibus concentricis granulis ad angulos; a vertice visae quadrangulares, lateribus retusis, angulis rotundis spinis binis in vertice et processibus duobus verruciformibus emarginatis intra marginem uniuscuiusque anguli. Long.  $24.5\mu$ , Lat.  $23.7\mu$ , Lat. isth.  $10\mu$ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Toyokoro in Tokachi; Konuma in Oshima. **Hondo**: Izu-numa in Rikuzen; **Kiushiu**: Nakahama of Lake Ikeda in Satsuma. (New to Asia) (Pl. XLII, fig. 4)

Distr. Central Africa.

**Staurationum furcatum** (EHRENB.) BRÉB. in WOILE Desm. U. S. 150, 1884; WEST Journ. Roy. Micr. Soc. 6, 292, 1890; WEST & CARTER Monogr. Brit. Desm. 5, 173, 1923; SMITH Wisc. Bull. 57, 118, 1924; KRIEGER Arch. Hydrobiol. suppl. 11, 199, 1932; TAYLOR Pap. Mich. Acad. Sci. 20, 190, 1935; HIRANO Act. Phytotax. Geobot. 12, 162, 1943.

Cellulae parvae, circiter tam longae quam latae cum processibus, profunde constrictae, sinu aperto acutangulo; semicellulae subellipticae, marginibus lateralibus dorsalibus et ventralibus aequaliter convexis, angulis lateralibus in processus breves robustos horizontaliter productis, apicibus processuum cum duobus denticulis, apicibus semicellularum cum processibus bifurcatis suberectis (6); a vertice visae triangulares, lateribus leviter concavis cum processibus duobus intra marginem, angulis in processus breves cum apicibus denticulatis productis. Long. sine proc.  $22.4-31\mu$ , cum proc.  $28-39\mu$ , Lat. sine proc.  $18-26.6\mu$ , cum proc.  $28-31\mu$ , Lat. isth.  $8.4-13\mu$ .

**Hab. Hokkaido:** Kiritappu, Tôro in Kushiro; Kamikoshi-ukishima in Ishikari; Tomakomai in Iburi; Shizukari in Oshima. **Hondo:** Chûkawa-ike, Ôishita, Hakuryu-ko, Mt. Azuma in Uzen; Naga-numa in Rikuzen; Oze in Kôzuke; Gakino-tanbo in Etchû; Shigakôgen, Tsuga-daira, Mt. Kirigamine in Shinano; Takashihara in Mikawa; Ishigaki-ike in Ise; Fuse-ike, Shinohara-ike, Mt. Hira in Oomi. **Shikoku:** Shiramizu-pass near Matsuyama in Iyo. **Kiushiu:** Nakahama of Lake Ikeda in Satsuma. (Pl. XLII, fig. 16)

Distr. Japan, Manchuria, Siberia, China, India, Sumatra, Java, whole Europe, Iceland, N. America, Australia, S. Africa.

forma **spinosa** GRÖNBL. in Act. Soc. Faun. Flor. Fenn. 47, pl. 1, f. 31, 32, 37, 1920.

Forma processibus ad angulos projectibus. Long.  $33.6\ \mu$ , Lat.  $30.8\ \mu$ , Lat. isth.  $11.3\ \mu$ .

**Hab. Hondo:** Hijiori-onuma in Uzen. (New to Asia) (Pl. XLII, fig. 17)  
Distr. Finland.

var. **subsenarium** W. & G.S. WEST in WEST & CARTER Monogr. Brit. Desm. 5, 175, 1923; HIRANO Act. Phytotax. Geobot. 12, 162, 1943.

Var. processibus dorsalibus brevioribus quam in forma typica, cellulis cum spinis simplicibus ventralibus et cum 2 seriebus concentricis granulorum ad angulos. Long. cum proc.  $28\ \mu$ , Lat. cum proc.  $28\ \mu$ , Lat. isth.  $8.4\ \mu$ .

**Hab. Hondo:** Mt. Hira in Oomi. (Pl. XLII, fig. 19)  
Distr. Japan, Europe.

**Staurastrum subavacula** W. & G.S. WEST in WEST & CARTER Monogr. Brit. Desm. 5, 181, 1923; OKADA Journ. Imp. Fish. Inst. 30, 189, 1934.

Cellulae parvae, circiter tam longae quam latae cum processibus, profunde constrictae, sinu aperto acutangulo; semicellulae subellipticae vel subcuneatae, marginibus ventralibus et dorsalibus ambo leviter convexis, angulis superioribus leviter productis cum duobus spinis et seriebus duobus granulorum infra angulos, apicibus semicellularum cum processibus bifidis binis; a vertice visae trigonae, lateribus rectis vel leviter concavis, angulis rotundis cum spinis binis et seriebus binis concentricis granulorum, apicibus semicellularum cum 6 processibus bifurcatis. Long. cum proc.  $32\ \mu$ , Lat. cum proc.  $33\ \mu$ , Lat. isth.  $11\ \mu$ .

**Hab. Hondo:** Ozegahara in Kôzuke. (New to Japan) (Pl. XLII, fig. 3)  
Distr. Kuriles, Europe.

**Staurastrum submonticulosum** ROY & BISSET in Journ. Bot. 24, 238, 1886.

Cellulae parvae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari ad extremum sed exterius aperto; semicellulae reniforme-

ellipticae, marginibus ventralibus convexis, marginibus lateralibus leviter productis in processus breves in apice bifidos, apicibus semicellularum convexis cum 6 processibus brevibus ordinatis; a vertice visae triangulares, lateribus paene rectis, cum seriebus processuum parvarum qui equidistant angulis intra marginem ordinatis, angulis obtusis spinis brevibus ordinatis. Long. 28–35  $\mu$ , Lat. 25–31  $\mu$ , Lat. isth. 9–15  $\mu$ .

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi; Horomui, Nakano near Sapporo in Ishikari. **Hondo**: Chûkawa-ike in Uzen; Mohara in Kamifusa. (Pl. XLII, fig. 10)

Distr. Japan, Thailand, Bohemia.

**Staurostrum senarium** (EHRENB.) RALFS in Brit. Desm. 216, 1848; WOLLE Desm. U. S. 147, 1884; TURNER K. Sv. Vet. Akad. Handl. 25, 119, 1893; WEST Journ. Linn. Soc. Bot. 39, 68, 1909; WEST & CARTER Monogr. Brit. Desm. 5, 175, 1923; ALLORGE Rev. Alg. 5, 366, 1930; KRIEGER Arch. Hydrobiol. suppl. 11, 206, 1932; HIRANO Act. Phytotax. Geobot. 12, 162, 1943.

Cellulae parvae, circiter  $1\frac{1}{2}$  latiores quam longae, profunde constrictae, sinu aperto acutangulo; semicellulae ellipticae vel subfusiformes, marginibus ventralibus et dorsalibus leviter convexis, angulis lateralibus gradatim productis in processus breves cum duobus spinis, apicibus semicellularum cum 6 processibus bifurcatis suberectis projectis, etiam processibus in seriebus horizontalibus trans semicellulas ornatis, et processibus omnibus glabris; a vertice visae triangulares, lateribus leviter concavis cum duobus processibus in medio et etiam processibus duobus intra marginem uniuscuiusque, angulis leviter productis. Long. sine proc. 21–31  $\mu$ , cum proc. 29–36  $\mu$ , Lat. cum spin. 27–34  $\mu$ , Lat. isth. 8.4–12  $\mu$ .

Hab. **Hokkaido**: Koetoi-konuma, Sarufutsu, Shimoyûbetsu in Kitami; Kamikoshi-ukishima in Ishikari; Yûfutsu in Iburi; Shizukari in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Mt. Hachimantai in Rikuchu; Koke-numa, Hirumo-numa, Megata, Mt. Komagatake in Ugo; Ôishita, Chûkawa-ike in Uzen; Izu-numa in Rikuzen; Nogiwano-kwannon-ike, Akai, Numano-taira of Mt. Bandai, Ningyo-ishi of Mt. Azuma in Iwashiro; Mt. Akagi, Ozegahara in Kôzuke; Senjôgahara in Shimotsuke; Mt. Naeba in Echigo; Shigakôgen, Tengenohara, Tsuga-daira, Kizaki in Shinano; Ishigaki-ike, Jôdo-ike in Ise; Shinohara-ike, Nukigawa, Mt. Hira in Oomi; Takaraga-ike, Ko-ike in Yamashiro. **Kiushiu**: Ahira in Ôsumi; Unagi-ike in Satsuma. (Pl. XLII, fig. 12)

Distr. Japan, Burma, India, Sumatra, Europe, U.S.A., Colombia, Australia.

var. **nigrae-silvae** SCHMIDLE in Ber. Dtsch. Bot. Ges. 11, 553, 1893; MIGULA Krypt. Fl. II, 554, 1907; DICK Bot. Arch. 3, 228, 1923.

Var. processibus leviter denticulatis et seriebus duobus concentricis denticulorum minutorum ad angulos ornatis. Long. cum proc. 39  $\mu$ , Lat. 36.4  $\mu$ ,



Lat. isth.  $12.5\ \mu$ .

Hab. **Hondo**: Oku-ike of Higashi-Kusano-mura in Oomi. (New to Asia) (Pl. XLIII, fig. 5)

Distr. Germany.

var. **simplex** HIRANO in Mem. Coll. Sci. Univ. Kyoto B, 19, 68, 1948.

Var. minor quam in forma typica, processibus inferioribus reductis in spinas longas. Long. sine proc.  $23\ \mu$ , cum proc.  $44\ \mu$ , Lat. cum proc.  $43\ \mu$ , Lat. isth.  $7\ \mu$ .

Hab. **Hondo**: Ozegahara in Kôzuke. (Pl. XLII, fig. 13)

Distr. Japan.

**Staurastrum forficulatum** LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 66, 1871; WEST & CARTER Monogr. Brit. Desm. 5, 187, 1923; OKADA ASAHINA's Inkwa. 187, 1939.

Cellulae modicae, circiter  $1\frac{1}{2}$  longiores quam latiores sine spinis et processibus, profunde constrictae, sinu acute aperto sed acuminato in verticem; semicellulae ellipticae vel subtrapeziformes, angulis lateralibus leviter productis in processus et duobus spinis longis robustis divergentibus et verticaliter ordinatis, apicibus semicellularum leviter convexis vel subtruncatis et processibus quaternis brevibus vel spinis emarginatis prominentiis ordinatis, marginibus superioribus et inferioribus cum verrucis 2-3 ad marginem et intra marginem; a vertice visae 3-4-gonae, lateribus concavis cum duobus processibus brevibus ad marginem et apicibus processuum emarginatis, et etiam duobus processibus juxta intra marginem, angulis leviter productis. Long.  $47.6\ \mu$ , Lat.  $39\ \mu$ , Lat. isth.  $14\ \mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi. (New to Japan) (Pl. XLII, fig. 6)  
Distr. Kuriles, Europe, U.S.A., Australia.

var. **verrucosum** GRÖNBL. in Act. Soc. Faun. Flor. Fenn. 47, 64, 1920.

Semicellulae subellipticae vel subtriangulares, sinu angusto-lineari exterius aperto, angulis lateralibus productis in processibus brevibus robustis cum apicibus tribus spinis brevibus, apicibus cum processibus 6, apicibus processuum trispinatis; a vertice visae triangulares, lateribus paene rectis cum processibus 6 ad marginem et processibus similibus 6 infra marginem, angulis in parte basis processuum cum granulis in seriebus concentricis circa angulos, processibus omnibus leviter longioribus quam in forma typica. Long. sine proc.  $39-45\ \mu$ , cum proc.  $48-56\ \mu$ , Lat. cum proc.  $37-42\ \mu$ , Lat. isth.  $14-19\ \mu$ .

Hab. **Hokkaido**: Horomui in Ishikari; Numanohata in Iburi; Shizukari in Oshima. **Hondo**: Naga-numa on Mt. Hachimantai in Rikuchu; Ôishita, Chûkawa-ike, Hakuryu-ko in Uzen; Bagyu-numa, Ojiroi in Iwaki; Akai in Iwashiro; Oze-ôgawa in Kôzuke; Inago of Kitamaki-mura, Happo-ridge,

Kamikôchi, Karuizawa, Kizaki in Shinano; Kanashôzu in Ise (Pl. XLII, fig. 1)  
Distr. Japan, Europe.

**Staurationum subbörgesenii** GRÖNBL. in Bot. Notis. 60, 1938; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 144, 1954.

Cellulae mediocres, tam longae quam latae sine processibus, profunde constrictae, sinu acuto acuminato ad apicem; semicellulae obverse triangulares, marginibus lateralibus convexis et apicibus latis, planis, angulis apicalibus in processus longos graciles solidos productis, profunde bifidis ad verticem; semicellulis cum serie processuum dorsalium et ventralium, processibus omnibus bifidis ad extremitatem; a vertice visae triangulares, lateribus leviter concavis cum processibus duobus emarginatis in medio utrinque, cum aliis processibus duobus similiter juxta et intra marginem ad basim processuum ventralium, angulis in processus longos graciles solidos bifidos productis. Long. sine proc.  $23.7\ \mu$ , cum proc.  $34-39\ \mu$ , Lat. sine proc.  $24-26\ \mu$ , cum proc.  $39-47\ \mu$ , Lat. isth.  $8.6\ \mu$ .

Hab. **Hokkaido**: Gono-numa of Mt. Daisetsu in Ishikari. **Hondo**: Lake Biwa in Oomi. (Pl. XLII, fig. 2)

Distr. Japan, Finland.

**Staurationum gemelliparum** NORDST. in WEST Trans. Linn. Soc. Bot. 6, 179, 1902; BORGE Ark. Bot. 15, 54, 1918; WEST & CARTER Monogr. Brit. Desm. 5, 176, 1923.—*Staurationum quadricornutum* ROY & BISSET in Journ. Bot. 24, 240, 1886.

Cellulae parvae, circiter tam longae quam latae vel leviter longiores cum processibus, profunde constrictae, sinu aperto et acuto leviter acuminato ad verticem; semicellulae subellipticae, marginibus ventralibus convexis, marginibus dorsalibus paene rectis vel leviter convexis, angulis apicalibus cum processibus quaternis (in parte superiori et inferiori) brevibus bifidis ornatis; a vertice visae triangulares, lateribus concavis, angulis truncatis et bifidis, cum processibus in parte superiori et inferiori, processibus omnibus glabris leviter attenuatis et brevibus. Long.  $25-34\ \mu$ , Lat.  $25-34\ \mu$ , Lat. isth.  $8-11\ \mu$ .

Hab. **Hokkaido**: Horomui in Ishikari; Konuma in Oshima. **Hondo**: Hakuryu-ko in Uzen; Biwa-ike in Owari. (Pl. XLII, fig. 9, 20)

Distr. Japan, Ceylon, British Isles, U.S.A., Brazil.

### Subgen. **Eustaurastrum**

*Staurationum* subgen. *Eustaurastrum* PRINTZ in ENGL. Pflanzenfam. 3, 357, 1927.

Cellulae conspicue constrictae, angulis productis in processus; semicellulae semicirculares, ellipticae, subtriangulares, cyathiformes vel campanulatae; membrana glabra vel serie granulorum vel denticulorum praedita; chromatophoris axialibus vel parietalibus.

- 1a. Cellulae cum processibus simplicibus ad angulos solum praeditae.
  - 2a. Processa glabra in toto margine longitudinis..... Sect. **Glabriformes**
  - 2b. Processa granulata, denticulata vel verrucosa in toto margine longitudinis..... Sect. **Processiformes**
- 1b. Cellulae cum processibus ad angulos et seriebus dorsalibus processuum ad superiores corporum praeditae.
  - 2a. Processa glabra..... Sect. **Radiatiformes**
  - 2b. Processa cum seriebus granulorum vel denticulorum praedita..... Sect. **Hoplastrum**

### Sect. **Glabriformes** HIRANO, sect. nov.

Cellulae ad angulos im processus productae, processibus apicalibus glabris non denticulo vel granulo in toto margine longitudinis ordinatis sed extremitatibus processuum glabris vel spinatis.

- 1a. Cellulae cum processibus ad angulos.
  - 2a. Processibus robustis, non elongatis, versus apices attenuatis, apice furcato vel obtuso.
    - 3a. Basis processuum glabra.
      - 4a. Cellulae minutae, 17–26 $\mu$  in longitudinem, sinu excavato... **St. inconspicuum**
      - 4b. Cellulae parvae, 27–36 $\mu$  in longitudinem, sinu acuto.
        - 5a. Apice processuum obtuso saepe bifurcato ..... **St. laevispinum**
        - 5b. Apice processuum 2–3 furcato.
          - 6a. Processibus non divis. .... **St. brachiatum**
          - 6b. Processibus divis. .... **St. ceylanicum**
    - 3b. Basis processuum cum serie spinarum..... **St. pulchrum**
    - 3c. Basis processuum cum serie verrucarum..... **St. distentum**
    - 2b. Processibus capitatis ad extremum ..... **St. bacillare** var. **obesum**
    - 2c. Processibus elongatis et gracilibus, spinatis ad extremum..... **St. gyratum**
  - 1b. Cellulae cum processibus duobus ad angulos..... **St. laeve**

**Staurastrum inconspicuum** NORDST. in Act. Univ. Lund 9, 26, 1873; WOLLE Desm. U.S. 125, 1884; WEST Trans. Linn. Soc. Bot. 5, 257, 1896; KAISER Krypt. Forsch. 1, 228, 1919; WEST & CARTER Monogr. Brit. Desm. 5, 86, 1923; HIRANO Act. Phytotax. Geobot. 12, 162, 1943.

Cellulae minutae, circiter tam longae quam latae cum processibus, modice constrictae, sinu aperto et paene semicirculares; semicellulae aspere quadrangulares, apicibus leviter elevatis et concavis in medio, angulis apicalibus productis in processus breves, robustos, oblique directos et subito attenuatos cum apicibus truncatis; a vertice visae 4-gonae, lateribus concavis, processibus rectis; membrana glabra. Long. cum proc. 17–22 $\mu$ , Lat. cum proc. 14–22 $\mu$ , Lat. isth. 7–9.8 $\mu$ .

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi; Kamikoshi-ukishima, Kumoigahara of Mt. Daisetsu in Ishikari; Shizukari in Oshima. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu; Mt. Kurikoma, Yatsumanako of Mt. Iwate in Rikuchu; Mt. Komagatake, Ogata, Koke-numa in Ugo; Mt. Gassan, Mt. Azuma, Ito-dake in Uzen; Akai in Iwashiro; Ômine-numa, Oze in

Kôzuke; Usagi-shima in Shimotsuke; Mt. Naeba, Kurosawano-ike, Kôyano-ike of Mt. Myoko in Echigo; Gakino-tanbo, Mt. Mitsumata-rengé, Mt. Tateyama in Etchû; Shigakôgen, Mt. Kirigamine, Happo-ridge, Tengunohara, Mt. Kazafuki in Shinano; Mt. Hira in Oomi. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XLIV, fig. 31)

Distr. Japan, Thailand, whole Europe, Faeroes, N. & S. America, Azores.

*Staurostrum inconspicuum* is widely distributed on the *sphagnum* bogs or pools in the alpine and subalpine regions of Japan, but is not found in the oligotrophic waters as CEDERCREUTZ said.

**Staurostrum laevispinum** BISSET in WEST Trans. Roy. Irish Acad. 32 3, 49, 1902; WEST & CARTER Monogr. Brit. Desm. 5, 90, 1923.

Cellulae parvae, leviter longiores quam latiores, profunde constrictae, sinu late aperto et rectangulari vel plus rectangulari; semicellulae leviter lunatae, marginibus lateralibus paene rectis, nonnumquam leviter convexis vel concavis, angulis productis in processus crassos attenuatos cum apicibus obtusis et nonnumquam bifidis, apicibus semicellularum concavis; a vertice visae triangulares, lateribus concavis, angulis in breves processus productis. Long. 21.5  $\mu$ , Lat. 17.3  $\mu$ , Lat. isth. 8.6  $\mu$ .

Hab. **Hondo**: Happo-ridge in Shinano. (New to Asia) (Pl. XLIII, fig. 14)

Distr. British Isles.

**Staurostrum brachiatum** RALFS in Brit. Desm. 131, 1848; WOLLE Desm. U.S. 124, 1884; ROY & BISSET Journ. Bot. 24, 238, 1886; WEST Trans. Linn. Soc. Bot. 5, 262, 1896; Journ. Linn. Soc. Bot. 34, 391, 1899; MIGULA Krypt. Fl. II, 551, 1907; SCHULZ Bot. Arch. 2, 138, 166, 1922; 1. c. 4, 253, 258, 1923; DICK 1. c. 3, 226, 1923; HOMFELD Pflanzenf. 12, 70, 1929; ALLORGE Rev. Alg. 5, 364, 1930; OKADA Journ. Imp. Fish. Inst. 30, 181, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 188, 1935; PRESCOTT & SCOTT Trans. Amer. Micr. Soc. 61, 20, 1942.

Cellulae parvae, circiter longiores quam latiores cum processibus, modice constrictae, sinu late aperto et rectangulari; semicellulae obverse triangulares sine processibus, marginibus lateralibus rectis, apicibus leviter concavis, angulis apicalibus in processus longos crassos glabros trifurcatis productis; a vertice visae triangulares, lateribus retusis, angulis in processus longos glabros productis, processibus unius semicellulae cum aliis alternantibus. Long. cum proc. 25-36  $\mu$ , Lat. cum proc. 33-39  $\mu$ , Lat. isth. 8.4-9.7  $\mu$ .

Hab. **Hokkaido**: Kamikoshi-ukishima, Numano-taira of Mt. Daisetsu in Ishikari; Tomakomai in Iburi; Shizukari in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Mt. Kurikoma in Ugo; Naga-numa in Rikuzen; Mt. Azuma, Mt. Gassan in Uzen; Akai in Iwashiro; Oze in Kôzuke; Kôridonono-ike in Echigo; Mt. Tateyama, Gakino-tanbo in Etchû; Inago of Kitamaki-mura, Mt. Kirigamine, Happo-ridge, Tsuga-daira, Tengunohara, Kizaki in Shinano;

Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. **Shikoku**: Yamada in Tosa. (Pl. XLIII, fig. 1)

Distr. Japan, Kuriles, whole Europe, Faeroes, Greenland, N. America, Australia, Azores, Cuiana.

*Staurastrum brachiatum* is widely distributed on the *sphagnum* moors or moor-swamps at the alpine and subalpine regions of Japan and is found abundantly among the submerged *sphagna* or other mosses.

**Staurastrum ceylanicum** W. & G. S. WEST in Trans. Linn. Soc. Bot. 6, 183, 1902; KRIEGER Arch. Hydrobiol. suppl. 11, 195, 1932.

Cellulae parvae, circiter latiores quam longiores cum processibus, modice constrictae, sinu late aperto ad verticem leviter acuminato; semicellulae cyathiformes vel campanulatae, apicibus leviter elevatis et convexis, angulis productis in processus glabros horizontaliter directos, ad apicem dilatatos, apicibus processuum divisus verrucis duabus et duabus spinis minutis in limitem ornatis; a vertice visae 5-6-gonae, lateribus concavis, angulis productis in processus breves divisus, et ad basim processuum pari spinarum. Long. 28  $\mu$ , Lat. cum proc. 24  $\mu$ , Lat. isth. 7.7  $\mu$ .

Hab. **Hondo**: Ôishitano-junsaitsumi in Uzen; Akaiyachi in Iwashiro; Kotsutsumi-nishi-ike in Mikawa. (New to Japan) (Pl. XLIII, fig. 7)

Distr. Ceylon, Java.

**Staurastrum bacillare** BRÉB. var. **obesum** LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 57, 1871; WEST Journ. Roy. Micr. Soc. 292, 1890; WEST & CARTER Monogr. Brit. Desm. 5, 84, 1923.

Cellulae maiores quam in forma typica, processibus horizontalibus et reductis, apicibus semicellularum leviter convexis. Long. 21-26.7  $\mu$ , Lat. 23.7-25.8  $\mu$ , Lat. isth. 8-8.4  $\mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi. **Hondo**: Izu-numa, Naga-numa in Rikuzen; Akai in Iwashiro; Shinohara-ike in Oomi. (New to Asia) (Pl. XLIII, fig. 3)

Distr. Europe, U.S.A.

**Staurastrum pulchrum** WOLLE in Bull. Torrey Bot. Club 7, 46, 1880; Desm. U. S. Pl. 41, f. 10, 1884.

Cellulae mediocres, circiter  $1\frac{1}{2}$  latiores quam longiores cum processibus sine spinis, modice constrictae, sinu late aperto paene rectangulari; semicellulae obverse subtriangulares vel campanulatae, marginibus lateralibus rectis vel leviter convexis, apice recto vel leviter retuso, angulis apicalibus in processus longos robustos horizontaliter vel leviter exterius directos productis, marginibus processuum glabris cum annulo denticulorum vel spinarum

minutarum ad basim et tribus spinis longis ad verticem, processibus attenuatis in basi leviter dilatatis ad apicem; a vertice visae 5-gonae, lateribus valide concavis paene semicircularibus, angulis in processus longos rectos attenuatos prope apicem leviter dilatatos productis, spina acuta ad basim uniuscujusque processus et spinis tribus ad apicem. Long. cum proc.  $28\ \mu$ , Lat. cum proc. et spin.  $39\ \mu$ , Lat. isth.  $9.8\ \mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. **Hondo**: Nukigawa in Oomi; Mizoroga-ike in Yamashiro; Ikejiri-ike in Tanba. (New to Asia) (Pl. XLIII, fig. 6)

Distr. U.S.A.

*Staurostrum pulchrum* does not exactly coincide with the WOLLE'S figure in his monograph by the shorter process which is dilated at the apex and is furnished with three sharp spines but his figure is not accurate, and it is uncertain whether it is figured in detail or not; however the general form of semicell in front as well as vertical view, and the deeply excavated margin between the processes and less nodulated processes in vertical view are characteristic of this species.

**Staurostrum distentum** WOLLE in WEST Journ. Linn. Soc. Bot. 33, 316, 1898; Ann. Roy. Bot. Gard. Calcutta 6, 223, 1907.

Cellulae raro parvae, leviter latiores quam longiores cum processibus, modice constrictae, sinu late aperto et paene rectangulari et acuminato ad verticem; semicellulae nonnihil cuneatae, marginibus lateralibus leviter convexis, apicibus paene rectis vel leviter retusis in medio, angulis superioribus productis in processus longos robustos horizontaliter vel leviter flectentes directos cum apicibus trispinatis, in basi processuum seriebus denticulorum vel processuum minorum emarginatorum praeditis; a vertice visae 5-gonae, lateribus concavis, angulis productis in processus longos rectos attenuatos ad apicem leviter dilatatos cum apicibus trispinatis, processibus parvis emarginatis ad basim processus uniuscujusque utrobique praeditis. Long.  $28\ \mu$ , Lat.  $34\ \mu$ , Lat. isth.  $10.7\ \mu$ .

Hab. **Hondo**: Nukigawa in Oomi. (New to Japan) (Pl. XLIII, fig. 4)

Distr. Burma, U.S.A.

**Staurostrum gyratum** W. & G. S. WEST in Ann. Roy. Bot. Gard. Calcutta 6, 219, 1907.

Cellulae parvae, circiter  $2\frac{1}{2}$  latiores quam longiores cum processibus, modice constrictae, sinu late aperto et rectangulari; semicellulae subtriangulares, marginibus lateralibus et apicibus leviter convexis, angulis apicalibus in processus longos tenuissimos minute serrato-crenatos, horizontaliter pro-

productos prope apicem leviter dilatatos; apicibus processuum acute trispinatis; a vertice visae triangulares, lateribus paene rectis, angulis in processus longos rectos non attenuatos prope apicem leviter dilatatos in apice trispinatos productis, processibus specialibus et oblique productis, marginibus lateralibus utriusque processus directe in marginem semicellulae continuatis. Long. 11.2–12.6  $\mu$ , Lat. cum proc. 38.7–39.2  $\mu$ , Lat. isth. 5.6  $\mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi. **Hondo**: Hizume in Rikuchû. (New to Japan) (Pl. XLIII, fig. 2).

Distr. Burma.

**Staurastrum laeve** RALFS in MIGULA Krypt. Fl. II, 551, 1907; WEST & CARTER Monogr. Brit. Desm. 5, 92, 1923; PRESCOTT Univ. Iowa Stud. 13, 136, 1931.

Cellulae parvae, circiter  $1\frac{1}{2}$  longiores quam latae cum processibus, profunde constrictae, sinu acuto et aperto; semicellulae subsemicirculares, marginibus ventralibus tumidis, apicibus leviter convexis, angulis apicalibus productis cum processibus duobus brevibus glabris attenuatis et in plano horizontali dispositis et oblique directis, et in apice bifidis; a vertice visae trigonae, lateribus concavis, angulis productis cum duobus processibus glabris attenuatis. Long. sine proc. 17  $\mu$ , cum proc. 25.8  $\mu$ , Lat. cum proc. 21.5  $\mu$ , Lat. isth. 6.5  $\mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. **Kiushiu**: Unagi-ike in Satsuma. (Pl. XLIII, fig. 8)

Distr. Japan, Java, Europe, Bornholm, U.S.A., Australia, Brazil.

#### Sect. **Processiformes** HIRANO, sect. nov.

Cellulae ad angulos in processus productae, processibus apicalibus granulo vel denticulo in toto margine longitudinis ordinatis, extremitatibus processuum generaliter spinatis.

- 1a. Cellulae sine spinis accessis prominentibus in corpore cellularum.
- 2a. Cellulae cum processibus brevibus ad angulos apicales, processibus brevioribus quam in longitudine corporis.
- 3a. Processibus rectis.
- 4a. Semicellulae ellipticae vel fusiformes, marginibus ventralibus et dorsalibus aequalibus convexis.
- 5a. Processibus in apice spinis evidentibus duabus ordinatis ..... **St. Reinschii** forma minor
- 5b. Processibus in apice spinis 3–4 ordinatis.
- 6a. Cellulae cum serie granulorum circa processus ordinatae.
- 7a. Cellulae in vertice visae serie multorum granulorum ordinatae, in centrum granulatae..... **St. hexacerum**

- 7b. Cellulae in vertice visae serie sparsim granulorum ordinatae, in centrum glabrae.
  - 8a. Cellulae tam longae quam latae, angulis apicalibus non productis in processus.....**St. polymorphum** var. **pygmaeum**
  - 8b. Cellulae latiores quam longiores, angulis apicalibus breve productis in processus.....var. **pusillum**
- 6b. Cellulae cum serie denticulorum circa processuum ordinatae .....**St. Haaboliense**
- 4b. Semicellulae cuneatae vel cyathiformes, marginibus ventralibus convexioribus quam marginibus dorsalibus.
  - 5a. Processibus divergentibus.
    - 6a. Cellulae in vertice visae 3-gonae, corporis cum serie granulorum.....**St. pseudotetracerum**
    - 6b. Cellulae in vertice visae 6-gonae, corporis glabris.....**St. asteroideum**
  - 5b. Processibus horizontalibus vel convergentibus.
    - 6a. Apice semicellularum glabro sine serie verrucarum ..... **St. polymorphum**
    - 7a. Cellulae in vertice visae sine spinis prominentibus ad marginem lateralem unumquemque.....f. **typica**
    - 7b. Cellulae in vertice visae cum spinis duabus prominentibus ad medium marginis lateralis uniuscuiusque.....var. **Grönbladii**
  - 6b. Apice semicellularum cum serie marginata verrucarum.
    - 7a. Cellulae 20-30 $\mu$  in longitudinem.
      - 8a. Apice processuum sine spinis.....**St. margaritaceum**
      - 9a. Semicellulae cyathiformes, processibus horizontalibus, basis processuum non inflata.....f. **typica**
      - 9b. Semicellulae ellipticae, processibus convergentibus, basis processuum inflata.....var. **robustum**
    - 8b. Apice processuum cum spinis.....**St. crenulatum**
    - 9a. Cellulae in fronte visae cum apice elevato, processibus longis.....f. **typica**
    - 9b. Cellulae in fronte visae sine apice elevato, processibus brevibus.....var. **continentale**
  - 7b. Cellulae 35-45 $\mu$  in longitudinem.....**St. proboscideum**
- 3b. Processibus curvatis; semicellulae cyathiformes..... **St. cyrtocentrum**
- 2b. Cellulae cum processibus longis ad angulos apicales, processibus generaliter longioribus quam longitudinem corporis.
  - 3a. Processibus rectis.
    - 4a. Cellulae sine seriebus basalibus prominentibus spinarum vel processuum supra isthmum.
      - 5a. Apice semicellularum glabro vel granulato sed non verrucoso.
        - 6a. Cellulae biradiatae.
          - 7a. Corpora cellularum sine protuberantia, in vertice visae elliptica vel oblonga.
            - 8a. Semicellulae rectangulares.
              - 9a. Processibus valide longis.....**St. columbetoides**
              - 9b. Processibus modice longis..... **St. iotantum** var. **longatus**
              - 9c. Processibus brevibus..... var. **tortum**
            - 8b. Semicellulae obtrapeziformes vel subtriangulares.



- 9a. Apice recto.
  - 10a. Sinu acuto.....**St. tetracerum**
    - 11a. Processibus mediocris..... f. **typica**
    - 11b. Processibus longis et gracilis..... var. **subexcavatum**
  - 10b. Sinu excavato..... **St. pseudoexcavatum**
    - 11a. Apice semicellularum recto..... f. **typica**
    - 11b. Apice semicellularum binoduloso et retuso ad medium..... var. **binodulum**
- 9b. Apice excavato..... **St. excavatum**
  - 10a. Apice angusto, processibus brevibus.
    - 11a. Cellulae sine processibus, 15 $\mu$  in longitudinem..... f. **typica**
    - 11b. Cellulae sine processibus, 11 $\mu$  in longitudinem..... var. **minimum**
  - 10b. Apice lato, processibus longis..... var. **planctonicum**
- 8c. Semicellulae campanulatae, corpora duplo longiora quam latiora..... **St. Johnsonii**
- 8d. Semicellulae lunato-cyathiformes, isthmo elongato..... **St. Karasuensis**
- 7b. Corpora cellularum cum granulato-protuberantia, in vertice visae elliptica cum inflatione utrobique..... **St. natator**
- 6b. Cellulae 3-6 radiatae.
  - 7a. Semicellulae rectangulares, angulis basalibus rectangularibus..... **St. iotantum**
  - 7b. Semicellulae cuneatae vel obtusangulares.
    - 8a. Processibus incurvatis.
      - 9a. Cellulae 21-26  $\mu$  in longitudinem, in vertice visae cum serie granulorum intra marginem lateralem unumquemque... **St. inflexum**
      - 9b. Cellulae 29-31  $\mu$  in longitudinem, in vertice visae cum serie emarginata granulorum intra marginem lateralem unumquemque..... **St. Sebaldi** var. **gracile**
    - 8b. Processibus divergentibus vel horizontalibus.
      - 9a. Cellulae parvae, 10-15  $\mu$  in longitudinem sine processibus.
        - 10a. Apice processuum sine spinis.
          - 11a. Processibus nodulatis, cellulae in vertice visae trigonae..... **St. tetracerum** forma **trigona**
          - 11b. Processibus glabris, cellulae in vertice visae 4-gonae..... **St. subtilissimum**
        - 10b. Apice processuum cum spinis acutis.
          - 11a. Processibus 1-3 nodulatis.
            - 12a. Processibus cum serie spinarum..... **St. micron**
            - 13a. Processibus cum serie singulis spinarum... var. **unidentatum**
            - 13b. Processibus cum serie 2-3 spinarum..... f. **typica**
          - 12b. Processibus cum serie acutorum granulorum, cum granulis duobus prominentibus prope basim..... **St. aestrophorum**
        - 11b. Processibus 4-5 nodulatis.
          - 12a. Cellulae in vertice visae sine spinis ad basim processuum..... **St. paradoxum** var. **parvum**

- 12b. Cellulae in vertice visae cum spinis ad basim  
processuum ..... **St. dentatum** var. **gracilis**
- 9b. Cellulae 15-50  $\mu$  in longitudinem sine processibus.
- 10a. Processibus generaliter horizontalibus.
  - 11a. Marginibus superioribus processuum cum serie prominentium  
denticulorum..... **St. dorsidentiferum** var. **ornatum**
  - 11b. Marginibus superioribus processuum sine serie denticulorum.
  - 12a. Cellulae in vertice visae 3-5-radiatae.
    - 13a. Cellulae 27-60  $\mu$  in longitudinem, generaliter  
3-radiatae, processibus longis ..... **St. gracile**
    - 13b. Cellulae 15-27  $\mu$  in longitudinem, generaliter 5-radiatae,  
processibus relative brevibus. . **St. asteroideum** var. **nanum**
  - 12b. Cellulae in vertice visae 6-radiatae, processibus longis,  
tam longae quam longitudo corporum  
..... **St. pentacrinum** var. **trisetum**
- 10b. Processibus generaliter divergentibus raro subhorizontalibus.
  - 11a. Semicellulae subfusiformes, angulis basalibus  
acutis..... **St. gracile** var. **subtenuissimum**
  - 11b. Semicellulae cuneatae, angulis basalibus rotundis.
    - 12a. Cellulae in vertice visae 3-4-radiatae.
      - 13a. Processibus attenuatis; cellulae in vertice visae 3-4-radiatae.
      - 14a. Processibus longissimis... **St. paradoxum** var. **longipes**
      - 14b. Processibus mediocriter longis.
      - 15a. Cellulae in vertice visae cum lateribus concavis.
        - 16a. Cellulae cum marginibus lateralibus non  
inflatis..... f. **typica**
        - 16b. Cellulae cum marginibus lateralibus  
inflatis..... **St. cingulum** var. **parvum**
      - 15b. Cellulae in vertice visae cum lateribus  
binodulis..... **St. paradoxum** var. **nodulosum**
    - 13b. Processibus dilatatis versus apicem; cellulae in  
vertice visae 4-radiatae..... **St. longistipes**
    - 14a. Processibus glabris..... f. **typica**
    - 14b. Processibus nodulatis..... var. **nodulosum**
  - 12b. Cellulae in vertice visae 6-radiatae, cum seriebus  
granulorum intra marginem.... **St. asterias** var. **divergens**
- 7c. Semicellulae campanulatae.
  - 8a. Cellulae generaliter 3-4-radiatae.
  - 9a. Cellulae in vertice visae cum lateribus glabris in  
corpore semicellularum.
  - 10a. Cellulae in vertice visae cum serie emarginata  
verrucarum intra marginem..... **St. longiradiatum**
  - 11a. Processibus longioribus et convergentibus, basis  
semicellularum cum sinu glabro vel cum denticulis  
duobus supra sinum..... f. **typica**
  - 11b. Processibus brevibus, leviter divergentibus, basis  
semicellularum cum denticulis tribus supra  
sinum..... var. **breviradiatum**

- 10b. Cellulae in vertice visae cum spinis duobus prominentibus intra marginem.....**St. oxyacanthum**
- 9b. Cellulae in vertice visae cum serie marginibus emarginato-verrucarum ad medium marginis uniuscuiusque...**St. pseudosebaldi**
- 9c. Cellulae in vertice visae cum serie marginibus simplicinarum ad medium marginis uniuscuiusque..... var. **simplicius**
- 9d. Cellulae in vertice visae cum serie marginibus emarginato-spinarum.
- 10a. Emarginato-spinis 4-6 in marginem unumquemque, processibus longis, multo nodulatis.....**St. elegantissimum**
- 10b. Emarginato-spinis 2 in marginem unumquemque, processibus brevibus, paulo nodulatis  
.....**St. zonatum** var. **emarginatum**
- 8b. Cellulae generaliter 5-6-radiatae.
- 9a. Cellulae in vertice visae cum serie radiali denticulorum, denticulis in parte dispositis et intra basim processuum...**St. asterias**
- 9b. Cellulae in vertice visae cum serie radiali denticulorum, denticulis inter processus dispositis.....**St. Arachne**
- 10a. Processibus horizontalibus vel leviter convergentibus... f. **typica**
- 10b. Processibus leviter divergentibus et curvatis.... var. **curvatum**
- 9c. Cellulae in vertice visae glabrae sine denticulis  
.....**St. zonatum** var. **ceylanicum** forma **convergens**
- 5b. Apice semicellularum cum serie verrucarum.
- 6a. Cellulae biradiatae.
- 7a. Cellulae cum verrucis duobus apicalibus, processibus divergentibus.....**St. dimazum** var. **elegantius**
- 7b. Cellulae cum verrucis apicalibus 6, processibus horizontalibus  
..... **St. Duacense**
- 6b. Cellulae 3-5-radiatae.
- 7a. Semicellulae cuneatae.
- 8a. Cellulae generaliter 3-radiatae, in vertice visae verrucae duae ad marginem unumquemque.
- 9a. Cellulae 21-35  $\mu$  in longitudinem, sine denticulis supra isthmum.....**St. gracile** var. **coronulatum**
- 9b. Cellulae 38-40  $\mu$  in longitudinem cum denticulis supra isthmum..... var. **ornatum**
- 8b. Cellulae generaliter 5-radiatae, processibus relative brevibus .....**St. sexcostatum** var. **productum**
- 7b. Semicellulae cyathiformes.
- 8a. Cellulae in vertice visae cum lateribus convexis vel rectis, processibus horizontalibus vel convergentibus.
- 9a. Cellulae in vertice visae 3-radiatae.....**St. Manfeldtii**
- 10a. Semicellulae in parte basali non inflatae, sine serie denticulorum..... f. **typica**
- 10b. Semicellulae in parte basali inflatae, cum serie transversali denticulorum.
- 11a. Serie 2, lateribus in vertice visis convexis....var. **annulatum**
- 11b. Serie 1, lateribus in vertice visis paulo concavis vel rectis..... var. **planctonicum**

- 9b. Cellulae in vertice visae 4-radiatae.
  - 10a. Semicellulae cum marginibus lateralibus glabris  
.....**St. Sebaldi** var. **productum**
  - 10b. Semicellulae cum marginibus lateralibus  
emarginato-verrucosis.....**St. Sebaldi** var. **ornatum**
- 8b. Cellulae in vertice visae cum lateribus concavis, processibus  
divergentibus.....**St. anatinum** var. **pelagicum**
- 7c. Semicellulae campanulatae, processibus divergentibus..... **St. pingue**
- 7d. Semicellulae elliptico-fusiformes, processibus convergentibus  
.....**St. Sonthalianum**
- 4b. Cellulae cum serie basali processuum.
  - 5a. Cellulae cum processibus apicalibus longis  
..... **St. tauphorum** var. **sumatranum**
  - 5b. Cellulae cum processibus apicalibus brevibus..... **St. Koidzumii**
- 3b. Processibus curvatis.
  - 4a. Processibus convergentibus.
    - 5a. Sinu acuminato; cellulae in vertice visae cum processibus  
rectis ..... **St. cerastes**
    - 5b. Sinu excavato; cellulae in vertice visae cum processibus curvatis  
..... **St. triforcipatum**
  - 4b. Processibus divergentibus.
    - 5a. Semicellulae subsphaericae, cum serie apicali granulorum,  
processibus subdivergentibus.....**St. acanthastrum**
    - 5b. Semicellulae cuneatae.
      - 6a. Processibus valide curvatis versus sursum, cellulae 32-35  $\mu$  in  
longitudinem.....**St. limneticum** var. **Burmense**
      - 6b. Processibus lateralibus curvatis, in vertice visae forma  
cyrtoceris; cellulae 20-22  $\mu$  in longitudinem..... **St. tenuissimum**
      - 5c. Semicellulae triangulari-cyathiformes; cellulae 44  $\mu$  in  
longitudinem.....**St. Biwaensis**
- 1b. Cellulae cum spinis accessis prominentibus in corpore cellularum.
  - 2a. Cellulae processibus rectis ordinatae.
    - 3a. Cellulae in parte basali sine processibus.
      - 4a. Semicellulae subellipticae, processibus brevibus..... **St. aculeatum**
      - 5a. Cellulae in vertice visae cum serie spinarum ad marginem unumquemque.
        - 6a. Cellulae cum serie apicali et ventrali prominentium spinarum... f. **typica**
        - 6b. Cellulae cum serie apicali et ventrali brevium spinarum  
.....var. **ornatum**
      - 5b. Cellulae in vertice visae cum processibus duobus non spinosis  
ad medium marginis uniuscuiusque.....var. **processum**
    - 4b. Processibus longis.
      - 5a. Semicellulae obtriangulares, processibus subdivergentibus  
.....**St. vestitum**
      - 6a. Cellulae in vertice visae cum processibus duobus prominentibus  
ad medium marginis uniuscuiusque.....f. **typica**
      - 6b. Cellulae in vertice visae cum processibus quaternis ad  
medium marginis uniuscuiusque, duobus medianis supermagnis  
..... var. **splendidum**
      - 5b. Semicellulae cuneatae, processibus horizontalibus, in vertice

- visae processibus duobus brevibus prope medium marginis  
uniuscuiusque.....**St. bicornulatum** var. **simplicius**
- 5c. Semicellulae cyathiformes, apice serie spinarum ordinato,  
processibus horizontalibus.....**St. Sebaldi**
- 5d. Semicellulae campanulatae, apice processibus bifurcatis utrobique  
ordinato..... **St. submanfeldtii**
- 3b. Cellulae in parte basali cum emarginato-processibus..... **St. subsaltans**
- 2b. Cellulae cum processibus curvatis.
- 3a. Semicellulae subellipticae vel subfusiformes, in vertice visae processibus  
in forma cyrtocerum curvatis.....**St. controversum**
- 3b. Semicellulae cuneatae, apice elevato cum spinis duobus utrobique,  
processibus incurvatis..... **St. saltans**
- 3c. Semicellulae campanulatae, apice convexo spinis duobus ad medium  
ordinato, processibus recurvatis versus sursum..... **St. leptocladum**

**Staurastrum Reinschii** ROY forma **minor** BORGE in Ark. Bot. 18, 22, 1923.

Cellulae minores quam in forma typica. Long. 21  $\mu$ , Lat. sine spin.  
24.4  $\mu$ , cum spin. 28  $\mu$ , Lat. isth. 5.6  $\mu$ .

Hab. **Hondo**: Ôishita in Uzen. (New to Asia) (Pl. XLIII, fig. 15)

Distr. Sweden.

**Staurastrum hexacerum** (EHRENB). WITTR. in WEST & CARTER Monogr. Brit. Desm. 5, 138, 1923; PRESCOTT Univ. Iowa Stud. 13, 136, 1931; Pap. Mich. Acad. Sci. 25, 91, 1940.

Cellulae parvae, circiter 1½ latiores quam longiores, profunde constrictae, sinu aperto et acutangulo; semicellulae fusiformes vel subtriangulares, marginibus ventralibus paene rectis vel leviter convexis, marginibus dorsalibus convexioribus quam ventralibus, apicibus convexis, angulis lateralibus leviter productis in processibus cum spinis tribus minutis ad angulos terminales; membrana minute granulata, granulis in seriebus concentricis ad angulos ordinatis; a vertice visae triangulares, lateribus concavis, angulis leviter turgidis, granulis in seriebus concentricis ad angulos ordinatis et diminutis in centro. Long. 20-22.4  $\mu$ , Lat. 28  $\mu$ , Lat. isth. 8.4-9.4  $\mu$ .

Hab. **Hokkaido**: Sarufutsu in Kitami; Minenobu in Ishikari. **Hondo**: Chûkawa-ike in Uzen; Kazafuki-koshiki-ike, Midoriga-ike, Amaga-ike of Mt. Yatsugatake in Shinano. (Pl. XLIII, fig. 11)

Distr. Japan, Siberia, Burma, whole Europe, Faeroes, Iceland, Spitzbergen, Greenland, Nova Zembla, N. & S. America, Australia, New Zealand, E. Africa, Madagascar, Azores.

**Staurastrum polymorphum** BRÉB. in RALFS Brit. Desm. 135, 1848; WOLLE Desm. U. S. 126, 1884; ROY & BISSET Journ. Bot. 24, 239, 1886; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 58, 1921; WEST & CARTER Monogr. Brit. Desm. 5, 125, 1923; DONAT Pflanzenf. 5, 23, 1926; TAYLOR Pap. Mich. Acad. Sci. 20, 196, 1935.

Cellulae parvae, circiter tam longae quam latae cum processibus, modice constrictae, sinu aperto acutangulo vel subrectangulari; semicellulae variables, subellipticae, subfusiformes vel subcyathiformes, marginibus ventralibus et dorsalibus ambo convexis, angulis apicalibus productis in processus breves robustos attenuatos horizontaliter vel leviter inflexos directos cum marginibus denticulatis et cum tribus spinis minutis ad apices processuum, cum seriebus annularibus transversis granulorum ad basim semicellularum; a vertice visae triangulares, lateribus leviter concavis, apicibus semicellularum glabris. Long. 23–32  $\mu$ , Lat. cum proc. 28–45  $\mu$ , Lat. isth. 6.3–11  $\mu$ .

Hab. **Hokkaido**: Okineppe in Nemuro; Kiritappu in Kushiro; Wakkanai, Sarufutsu in Kitami; Yûfutsu in Iburi. **Hondo**: Ôishita in Uzen; Izu-numa in Rikuzen; Ômine-numa, Ozegahara in Kôzuke; Gôno-ike in Hitachi; Inago of Kitamaki-mura in Shinano; Fuse-ike, Matsubara-naiko in Oomi. **Shikoku**: Yodo-mura, Morimatsu in Iyo. **Kiushiu**: Imuta-ike in Satsuma; Koshiki-ike of Mt. Kirishima in Hiuga. (Pl. XLIII, fig. 22)

Distr. Japan, Manchuria, Siberia, Mongolia, Ceylon, whole Europe, Nova Zembla, Faeroes, Franz Joseph Land, Spitzbergen, Greenland, N. America, central Africa, Patagonia.

var. **pygmaeum** GRÖNBLAD in Act. Soc. Faun. Flor. Fenn. 49, 59, 1921.

Semicellulae minores, fusiformes, processibus brevibus cum seriebus duabus radialibus granulorum et apice trispinato instructis, apicibus semicellularum emarginato-bidentatis. Long. 28  $\mu$ , Lat. sine spin. 39  $\mu$ , Lat. isth. 11.3  $\mu$ .

Hab. **Hondo**: Mt. Iwaki in Mutsu. (New to Asia) (Pl. XLIII, fig. 28)

Distr. Finland.

var. **pusillum** WEST in WEST & CARTER Monogr. Brit. Desm. 5, 127, 1923.

Cellulae minores, processibus leviter convergentibus, corpore semicellularum simili formae typicae. Long. 19.4  $\mu$ , Lat. 23.6  $\mu$ , Lat. isth. 6.5  $\mu$ .

Hab. **Hokkaido**: Minenobu in Ishikari. (New to Asia) (Pl. XLIII, fig. 24)

Distr. British. Isles.

var. **Grönbladii** HIRANO in Mem. Coll. Sci. Univ. Kyoto, B, 19, 67, 1948.—*Staurastrum polymorphum* BRÉB. *forma* GRÖNBLAD in Act. Soc. Faun. Flor. Fenn. 47, 73, 1920.—*Staurastrum Heimerlianus* LÜTKEM. *forma* TAYLOR in Pap. Mich. Acad. Sci. 20, 192, 1935.

Semicellulae minores, subtriangulares, processibus longis horizontaliter vel leviter subdivergentibus minutissime nodulosis; a vertice visae triangulares, lateribus leviter concavis, et in centra marginum spinis binis longis verticalibus prominentibus; apex glabra. Long. cum proc. 17  $\mu$ , Lat. cum proc. 31  $\mu$ , Lat. isth. 8  $\mu$ .

Hab. **Hondo**: Ayamedaira in Kôzuke; Kurosawano-ike of Mt. Myoko in Echigo; Kumono-taira in Etchû. (Pl. XLIII, fig. 16)

Distr. Japan, Finland, New Foundland.

**Staurastrum Haaboeliense** WILLE in WOLLE Desm. U.S. 131, 1884; WEST & CARTER Monogr. Brit. Desm. 5, 140, 1923; PRESCOTT Univ. Iowa Stud. 13, 136, 1931.

Cellulae parvae, leviter latiores quam longiores, profunde constrictae sinu acute aperto; semicellulae late elliptico-fusiformes vel subtriangulares, angulis productis in processus breves attenuatos cum annulo spinarum minutarum, processibus cum seriebus concentricis 3-4 denticulorum; a vertice visae trigonae, lateribus leviter concavis, angulis leviter productis et truncatis cum spinis annularibus. Long. 17-25  $\mu$ , Lat. cum proc. 19.6-26  $\mu$ , Lat. isth. 4.2-8.4  $\mu$ .

Hab. **Hokkaido**: Akan-junsai-numa, Tôro, Kiritappu in Kushiro; Horomui in Ishikari; Tomakomai in Iburi. **Hondo**: Mt. Iwaki in Mutsu; Chûkawa-ike in Uzen; Mohara in Kamifusa. (New to Asia) (Pl. XLIII, fig. 10)

Distr. Europe, U.S.A., Australia.

**Staurastrum pseudotetracerum** (NORDST.) W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 79, 1895; WEST & CARTER Monogr. Brit. Desm. 5, 122, 1923; KRIEGER Hedw. 70, 148, 1930.—*Staurastrum contortum* DELP. var. *pseudotetracerum* NORDST. in K. Sv. Vet. Akad. Handl. 22, 50, 1888; DICK Bot. Arch. 3, 226, 1923.

Cellulae parvae, leviter latiores quam longiores cum processibus, profunde constrictae, sinu late aperto et paene rectangulari; semicellulae cuneatae, angulis apicalibus productis in processus breves in margine denticulatos et leviter ad exterius curvatos, apicibus processuum spinis 3-4 minutis ordinatis, apicibus semicellularum leviter convexis; a vertice visae triangulares, lateribus leviter concavis, angulis productis in processus denticulatos. Long. sine proc. 19.6  $\mu$ , cum proc. 28  $\mu$ , Lat. cum proc. 23-28  $\mu$ , Lat. isth. 7-8.4  $\mu$ .

Hab. **Hondo**: Mohara in Kamifusa; Higusa-numa in Shimofusa; Takashihara in Mikawa. (New to Japan) (Pl. XLIII, fig. 17)

Distr. Ceylon, Borneo, Europe, U.S.A., Africa, Azores, Madagascar, New Zealand.

**Staurastrum asteroideum** WEST in Trans. Linn. Soc. Boc. 5, 263, 1896.

Cellulae parvae, leviter latiores quam longiores cum processibus, modice constrictae, sinu acuto et acuminato ad apicem; semicellulae cuneatae, apicibus convexis, angulis apicalibus productis in processus 2-3 nodulosos divergente et aliquando leviter ad exterius curvatos in apice minuto trispinatos; a vertice visae 6-angulares, processibus leviter brevioribus quam in longitudinis corporis, apice semicellularum glabro. Long. 27.5  $\mu$ , Lat. cum

proc.  $34.4\ \mu$ , Lat isth.  $12\ \mu$ .

Hab. **Hondo**: Lake Biwa in Oomi. (New to Asia) (Pl. XLIV, fig. 12, 13)  
Distr. U.S.A.

var. **nanum** (WILLE) GRÖNBL. in Bot. Notis. 418, 1948; HIRANO Act. Phytotax. Geobot. 14, 102, 1952.—*Staurostrum gracile* RALFS var. *nanum* WILLE in WEST & CARTER Monogr. Brit. Desm. 5, 100, 1923; SKVORTZOW Philip. Journ. Sci. 49, 153, 1932; OKADA Journ. Imp. Fish. Inst. 30, 183, 1934; FUJISAWA Journ. Jap. Bot. 10, 444, 1934.

Cellulae paullo parviores quam in forma typica, cum processibus brevioribus et horizontalibus, apicibus semicellularum leviter convexis, cellulis cum serie transversa granulorum trans basim et supra isthmum semicellularum. Long.  $22.4-28\ \mu$ , Lat. cum proc.  $31-39\ \mu$ , Lat. isth.  $8.4-9.8\ \mu$ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Kiritappu in Kushiro; Toyokorokonuma in Tokachi; Horomui in Ishikari; Yûfutsu, Tôasa-numa, Numano-hata in Iburi; Shizukari, Junsai-numa, Konuma in Oshima. **Hondo**: Nagatai of Mt. Iwaki in Mutsu; Nishi-numa, Futatsuyagata, Ogata, Kawashiri in Ugo; Hakuryu-ko, Ôishita, Mazawano-naga-numa in Uzen; Izu-numa, Kesho-numa in Rikuzen; Akaiyachi in Iwashiro; Oze-numa in Kôzuke; Kitaura, Ushiku-numa in Hitachi; Ôike of Matsunoyama in Echigo; Inago of Kitamakimura, Sennin-ike, Daizahôshi-ike, Mt. Kirigamine, Lake Nakatsuna in Shinano; Biwa-ike in Owari; Matsubara-naiko, Shinohara-ike, Fuse-ike in Oomi; Ariga-ike Shakuhachi-ike, Rokujizo in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Dôgo in Iyo. **Kiushiu**: Unagi-ike, Nakahara-ike in Satsuma. (Pl. XLIV, fig. 14)

Distr. Japan, Korea, Kuriles, Manchuria, Mongolia, Ceylon, Asia Minor, Europe, U.S.A.

**Staurostrum margaritaceum** (EHRENB.) MENECH. in RALFS Brit. Desm. 134, 1848; WOLLE Desm. U. S. 125, 1884; WEST Journ. Bot. 27, 294, 1889; Journ. Roy. Micr. Soc. 6, 296, 1890; WEST & CARTER Monogr. Brit. Desm. 5, 131, 1923; OKADA Journ. Imp. Fish. Inst. 30, 185, 1934.

Cellulae parvae, circiter longiores quam latiores, modice constrictae, sinu aperto; semicellulae variables, poculi-formes, subfusiformes, marginibus dorsalibus convexis, marginibus ventralibus leviter convexis, angulis lateralibus productis in processus breves obtusos horizontaliter vel leviter inflexos; membrana aspere granulata, granulis in serie concentricis ad angulos ornatis, cum unico annulo granulorum minorum ad basim semicellulae; a vertice visae quadrangulares, lateribus concavis, angulis productis in processus breves, truncatos cum granulis in seriebus concentricis ad angulos; granula emarginata ad basim processus uniuscujusque utrobique, in centro semicellula glabra. Long.  $21-31\ \mu$ , Lat. cum proc.  $22.4-28\ \mu$ , Lat. isth.  $5-9\ \mu$ .



**Hab. Hokkaido:** Sarufutsu in Kitami; Nakano of Sapporo, Moere-numa, Mt. Daisetsu, Kamikoshi-ukishimahara in Ishikari; Tomakomai in Iburi; Konuma in Oshima. **Hondo:** Mt. Hakkoda, Mt. Hachimantai, Kurobo-numa, Bora-numa, Kotsutsumi in Mutsu; Koke-numa, Hosonuma, Aka-numa, Hirumonuma in Ugo; Yatsumanako of Mt. Iwate, Mt. Kurikoma in Rikuchu; Mt. Sugigamine of Zawo, Ōishita, Mt. Azuma in Uzen; Izu-numa in Rikuzen; Akagi-konuma, Oze in Kôzuke; Usagi-shima in Shimotsuke; Mt. Naeba in Echigo; Mt. Tateyama, Mt. Yakushi, Kumono-taira, Mt. Kaminotake, Kurobegoro-daira, Gakino-tanbo, Sennin-ike in Etchû; Shigakôgen, Mt. Kirigamine, Inago of Kitamaki-mura, Happo-ridge, Shirouma-ôike, Tsuga-daira, Mt. Kazafuki, Kizaki in Shinano; Takashihara, Ō-numa in Mikawa; Mt. Hira, Nukigawa in Oomi; Shakuhachi-ike, Rokujizo in Yamashiro. **Shikoku:** Yamauchi-mura in Sanuki; Yodo-mura in Iyo. **Kiushiu:** Kôga-muta of Aso in Higo; Bôgatsuru of Mt. Kujû in Bungo. (Pl. XLIII, fig. 23, 29)

Distr. Japan, Kuriles, Manchuria, China, Siberia, Thailand, India, Java, Celebes, whole Europe, Spitzbergen, Greenland, N. America, Sandwich-islands, Brazil, Tasmania.

**var. robustum** W. & G. S. WEST in WEST & CARTER Monogr. Brit. Desm. 5, 133, 1923; PRESCOTT Pap. Mich. Acad. Sci. 25, 93, 1940; HIRANO Bot. Mag. 66, 207, 1953.

Var. robustior, sinu elliptico; semicellulae late ellipticae sine processibus, processibus attenuatis et inflexis in margine triundulatis; in vertice visae generalis 6-gonae, verruca parva ad basim uniuscuiusque utrobique ornata. Long. 22  $\mu$ , Lat. cum proc. 28  $\mu$ , Lat. isth. 8  $\mu$ .

**Hab. Hondo:** Mt. Hakkoda in Mutsu; Mt. Komagatake in Ugo; Mt. Gassan in Uzen; Oze in Kôzuke; Mt. Naeba in Echigo; Tarobei-daira in Etchû. (Pl. XLIV, fig. 7)

Distr. Japan, Thailand, England, Letland.

**Staurastrum crenulatum** (NÄG.) DELP. in WEST & CARTER Monogr. Brit. Desm. 5, 110, 1923; DICK Mitt. Pfälz. Ver. Nat. Pollichia n. s. 3, 137, 1930; PRESCOTT Pap. Mich. Acad. Sci. 25, 91, 1940; HIRANO Bot. Mag. 66, 208, 1953.

Cellulae parvae, latiores quam longiores cum processibus, profunde constrictae, sinu aperto acutangulo aliquando rectangulari; semicellulae subfusiformes, marginibus lateralibus inferioribus leviter tumidis, apicibus late truncatis et in parte mediana leviter elevatis, angulis lateralibus elevatis cum duabus verrucis, angulis lateralibus productis in processibus longis tenuis denticulatis cum spinis tribus brevibus, processibus paene horizontaliter vel leviter subdivergentibus dispositis cum serie transversa spinarum infra apicem; a vertice visae tetragonae, lateribus concavis cum verrucis duabus emargi-

natis prope partem medianam utriusque et denticulis tribus prope processus uniuscuiusque utrobique. Long. 17–28  $\mu$ , Lat. cum proc. 23.7–39  $\mu$ , Lat. isth. 5.7–7.5  $\mu$ .

Hab. **Hokkaido**: Onne-numa in Nemuro. **Hondo**: Chûkawa-ike in Uzen; Kurobegoro-daira in Etchû; Daizahôshi-ike in Shinano. (Pl. XLIII, fig. 18)

Distr. Japan, whole Europe, Faeroes, N. America, E. Africa.

var. **continentale** MESSIK. in Viertelj. Nat. Ges. Zurich 73, 207, 1928; HIRANO Bot. Mag. 66, 209, 1953.

Var. processibus brevioribus quam in forma typica et leviter inflexis, apicibus convexis (non elevatis); lateribus a vertice visis leviter concavis, processibus leviter curvatis (ut in *St. cyrtoceras*). Long. 23.6–25.8  $\mu$ , Lat. 25–26  $\mu$ , Lat. isth. 8.6  $\mu$ .

Hab. **Hondo**: Koke-numa in Ugo; Happo-ridge in Shinano. (Pl. XLIII, fig. 19)

Distr. Japan, Switzerland.

**Staurastrum proboscideum** (BRÉB.) ARCH. in WEST & CARTER Monogr. Brit. Desm. 5, 129, 1923; DICK Mitt. Pfalz Ver. Nat. Pollichia 3, 140, 1930; WHELDEN Nat. Mus. Canad. Bull. 97, 109, 1943; HIRANO Jap. Journ. Bot. 14, 230, 1954.

Cellulae mediocres, circiter longiores quam latae cum processibus, profunde constrictae, sinu late aperto leviter acuminato ad verticem; semicellulae subellipticae vel subcuneatae, apicibus et marginibus lateralibus leviter convexis, angulis apicalibus productis in processus breves robustos horizontaliter directos cum apicibus truncatis et annulo granulorum minorum ad verticem ornatis, processuum seriebus concentricis granulorum ornatorem; in parte superiori semicellulae cum seriebus apicalibus granulorum (vel aliquando verrucarum emarginatarum in summitate), cum annulis granulorum horizontalium ad basim semicellularum; a vertice visae quadrangulares, lateribus concavis, angulis productis in processus breves truncatos cum granulis in seriebus concentricis sed irregulariter sparsis prope basim processuum; centro glabro. Long. 31.4–44.8  $\mu$ , Lat. 31–53  $\mu$ , Lat. isth. 14–16  $\mu$ .

Hab. **Hokkaido**: Tôro in Kushiro. **Hondo**: Mt. Sugigamine of Zawo in Uzen; Mt. Akagi in Kôzuke; Gakino-tanbo in Etchû; Kotsutsumi-nishi-ike in Mikawa. (Pl. XLIII, fig. 20, 21)

Distr. Japan, China, whole Europe, Spitzbergen, Greenland, Arctic Canada, central Africa.

**Staurastrum cyrtoceras** BRÉB. in RALFS Brit. Desm. 139, 1848; WOLLE Desm. U.S. 128, 1884; WEST Journ. Roy. Micr. Soc. 6, 18, 1890 (reprint); WEST & CARTER Monogr. Brit. Desm. 5, 135, 1923; DONAT Pflanzenf. 5, 22, 1926; SKUJA Act. Horti Bot. Univ. Latv. 3, 185, 1928; DICK Mitt. Pfalz Ver. Nat. Pollichia 3, 137, 1930; HIRANO Bot. Mag. 66, 209, 1953.

Cellulae parvae, circiter  $1\frac{1}{2}$  duplo latiores quam longiores cum processibus, modice constrictae, sinu aperto et acutangulo vel rectangulari; semicellulae cyathiformes, marginibus lateralibus inferioribus convexis, marginibus superioribus convexis cum minutis verrucis emarginatis praeditis, angulis superioribus in processus robustos incurvatos nodulosos leviter attenuatos productis, apicibus processuum truncatis et cum spinis minutis duabus vel tribus; membrana sparsim granulata, granulis in annulis concentricis ad processus, circiter 6 seriebus apparentibus, cum seriebus annulorum granulorum minorum ad basim semicellularum; a vertice visae trigonae, lateribus concavis, serie una granulorum minorum emarginatarum intra marginem uniuscuiusque. Long. 26.6–39  $\mu$ , Lat. cum proc. 34–60  $\mu$ , Lat. isth. 7–14  $\mu$ .

Hab. **Hokkaido**: Sarufutsu in Kitami; Tomakomai in Iburi. **Hondo**: Ôshitano-junsai-tsutsumi in Uzen; Bagyu-numa, Hibushi-numa in Iwaki; Oze-numa in Kôzuke; Kazafuki-koshiki-ike in Shinano. (Pl. XLIII, fig. 12, 13)

Distr. Japan, Asia Minor, whole Europe, Spitzbergen, N. & S. America, Australia.

**Staurastrum columbetoides** W. & G. S. WEST in Trans. Linn. Soc. Bot. 6, 186, 1902; HIRANO Act. Phytotax. Geobot. 14, 51, 1950.

Cellulae mediocres, leviter longiores quam latiores, modice constrictae, sinu angusto-lineari; semicellulae rectangulares, in parte basali semicellularum leviter inflatis, angulis basalibus rectangulari-rotundatis, apice truncato et recto vel leviter concavo, angulis in processus longos divergentes nodulosos leviter attenuatos cum apicibus bifidos productis; a vertice visae fusiformes cum processibus longis. Long. sine proc. 15–16.8  $\mu$ , cum proc. 70  $\mu$ , Lat. sine proc. 12.6–14  $\mu$ , cum proc. 36.4–56  $\mu$ , Lat. isth. 4.3–7  $\mu$ .

Hab. **Hondo**: Nogiwano-kwannon-ike in Iwashiro; Fuse-ike in Oomi. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XLIV, fig. 1)

Distr. Japan, Ceylon.

**Staurastrum iotantum** WOLLE in Desm. U. S. 137, 1884; WEST Journ. Linn. Soc. Bot. 33, 314, 1898; TAYLOR Pap. Mich. Acad. Sci. 20, 192, 1935; PRESCOTT l. c. 25, 92, 1940.

Cellulae parvae, leviter latiores quam longiores cum processibus, profunde constrictae, sinu acutangulo aperto; semicellulae rectangulares, angulis basalibus subrectangularibus, marginibus lateralibus leviter divergentibus, apicibus paene rectis vel leviter concavis, angulis apicalibus in processus longos divergentes nodulosos productis, apicibus processuum truncatis et minute trispinatis; a vertice visae triangulares, lateribus subrectis, angulis in processus longos nodulosos productis. Long. sine proc. 11  $\mu$ , cum proc. 18–22  $\mu$ , Lat. sine proc. 9.8  $\mu$ , cum proc. 18–22  $\mu$ , Lat. isth. 4–5  $\mu$ .

**Hab. Hokkaido:** Kiritappu in Kushiro; Tomakomai in Iburi. **Hondo:** Nogiwano-kwannon-ike in Iwashiro. (New to Japan) (Pl. XLIV, fig. 3)  
**Distr.** Ceylon, Switzerland, N. America.

**var. tortum** TEILING in Sv. Bot. Tidskr. 10, 65, 1916.

Semicellulae in vertice visae biradiatae; in fronte visae late rectangulares, paene tam longae quam latae vel leviter latiores. Long. sine proc.  $11\mu$ , cum proc.  $28\mu$ , Lat. cum proc.  $28\mu$ , Lat. isth.  $8.4\mu$ .

**Hab. Hondo:** Koke-numa in Ugo; Rokujizo in Yamashiro. (New to Asia) (Pl. XLIV, fig. 4)

**Distr.** Sweden.

**var. longatus** HIRANO, var. nov.

**Var.** apicibus cellularum leviter angustioribus, processibus longioribus. Long. cum proc.  $38.7\mu$ , Lat. cum proc.  $43\mu$ , Lat. isth.  $4\mu$ .

**Hab. Hondo:** Eboshi-numa in Uzen; Okemi-ike in Shinano; Kotsutsumi-nishi-ike in Mikawa. (Pl. XLIV, fig. 5)

**Staurostrum tetracerum** RALFS in Brit. Desm. 137, 1848; WEST & CARTER Monogr. Brit. Desm. 5, 118, 1923; WORONICHIN Act. Inst. Bot. Acad. Sci. Urss, 2, Pl. Crypt. 2, 141, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 198, 1935; BERGE Ark. Bot. 28A, 46, 1936; PRESCOTT Pap. Mich. Acad. Sci. 25, 95, 1940; HIRANO Act. Phytotax. Geobot. 12, 163, 1943; TAFT Ohio Journ. Sci. 45, 204, 1945.

Cellulae minutae, circiter tam longae quam latae cum processibus, modice constrictae, sinu late aperto ad apicem acutangulo; semicellulae subrectangulares, marginibus lateralibus leviter convexis, apicibus rectis vel leviter concavis, angulis apicalibus productis in processus longos gracillimos leviter attenuatos nodulosos deflecte directos, apicibus processuum leviter dilatatis et truncatis; a vertice visae biradiatae, fusiformes. Long. sine proc.  $9\mu$ , cum proc.  $22-36\mu$ , Lat. cum proc.  $25-33\mu$ , Lat. isth.  $4-7\mu$ .

**Hab. Hokkaido:** Okineppe, Onne-numa in Nemuro; Kiritappu, Akan-junsai-numa in Kushiro; Nikuru-numa in Kitami; Toyokoro in Tokachi; Horomui, Nakano of Sapporo in Ishikari; Tomakomai, Yûfutsu, Numanohata in Iburi; Shizukari, Ko-numa, Junsai-akanuma in Oshima. **Hondo:** Hirumomuma, Megata, Moritake-ôtsutsumi, Aka-numa in Ugo; Hakuryu-ko, Eboshi-numa, Chûkawa-ike, Ôishita in Uzen; Hizume in Rikuchû; Izu-numa, Naganuma, Kesho-numa, Kirifushi-numa in Rikuzen; Bagyu-numa in Iwaki; Nogiwano-kwannon-ike, Kôriyama, Akai in Iwashiro; Kanazuka-mura in Echigo; Gôno-ike, Kitaura in Hitachi; Hakkaku-ike in Kamifusa; Higusanuma in Shimofusa; Kamaga-ike of Otari, Mt. Kirigamine, Daizahôshi-ike, Tsuga-daira, Koyamada-ike, Kanori-ike in Shinano; Takashihara, Suhara-ike,

Ônuma in Mikawa; Tanuki-numa in Suruga; Toba, Ishigaki-ike, Jôdo-ike in Isé; Nukigawa, Shinohara-ike, Mt. Hira in Oomi; Takaraga-ike, Mizoroga-ike, ko-ike, Sawano-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Sumiyoshi-ike of Misato-mura in Tosa. **Kiushiu**: Imuta-ike, Nakahama of Lake Ikeda, Kagami-ike in Satsuma; Miyazaki, Kirishima-koike in Hiuga; Ahira in Ôsumi. (Pl. XLIII, fig. 25-27)

Distr. Japan, Siberia, China, Burma, Ceylon, Abyssinia, whole Europe, Iceland, Greenland, N. & S. America, Australia, central Africa, Madagascar, Azores.

forma **trigona** LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 69, 1871; WEST & CARTER Monogr. Brit. Desm. 5, 120, 1923; KRIEGER Arch. Hydrobiol. suppl. 11, 208, 1932; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 53, 1935; HIRANO Act. Phytotax. Geobot. 14, 103, 1952.

Forma cellularum in vertice visae trigona, similis formae typicae. Long. 19-21  $\mu$ , Lat. 21-22  $\mu$ , Lat. isth. 6-6.5  $\mu$ .

Hab. **Hokkaido**: Akan-junsai-numa in Kushiro; Yûfutsu, Benten-numa in Iburi. **Hondo**: Ogata in Ugo; Kitaura in Hitachi; Hakkaku-ike in Kamifusa; Happo-ridge, Okemi-ike, Mt. Kirigamine in Shinano. **Kiushiu**: Lake Ikeda in Satsuma. (Pl. XLIV, fig. 6)

Distr. Japan, Europe.

var. **subexcavatum** GRÖNBL. in Act. Soc. Faun. Flor. Fenn. 49, 62, 1921.

Cellulae minores, processibus longioribus; semicellulae subrectangulares, angulis basalibus subrectangularibus, apicibus rectis vel leviter retusis. Long. sine proc. 12.6  $\mu$ , cum proc. 33.6  $\mu$ , Lat. cum proc. 47  $\mu$ , Lat. isth. 5.6  $\mu$ .

Hab. **Hondo**: Takaraga-ike in Yamashiro. (New to Asia) (Pl. XLIV, fig. 2)

Distr. Europe.

This variety does not exactly coincide with the GRÖNBLAD'S form by the flattened apex instead of subexcavated, but its general form of semicell, basal angles, and direction of processes and length, are quite similar to that form. SKVORTZOW has recorded an interesting form of this species from Manchuria but this variety differs from his form in the direction of process and smaller size of cell.

**Staurastrum biexcavatum** HIRANO in Act. Phytotax. Geobot. 14, 103, 1952.

Cellulae submediocres, leviter longiores quam latiores, modice constrictae, sinu excavato, isthmo leviter elongato et saepe torto; semicellulae cuneatae vel subrectangulares, angulis basalibus aliquantum rectangularibus aliquando non evidentis, apicibus paene rectis vel leviter retusis, angulis apicalibus in

processus longos divergentes circa 7 nodulosos et leviter attenuatos in apice minute trispinatos productis; a vertice visae biradiatae, ellipticae saepe tortae ad isthmum. Long. cum proc. 40–41  $\mu$ , Lat. cum proc. 35–38  $\mu$ , Lat. isth. 8  $\mu$ .

Hab. **Hondo**: Kitaura in Hitachi. **Kiushiu**: Lake Unagi in Satsuma. (Pl. XLIV, fig. 10)

Distr. Japan.

var. **binodulum** HIRANO, var. nov.

Var. apicibus semicellularum binodulatis, parte mediana retusa, parte basali processuum valide inflata. Long. cum proc. 34.4  $\mu$ , Lat. cum proc. 41  $\mu$ , Lat. isth. 6.5  $\mu$ .

Hab. **Hondo**: Megata in Ugo. (Pl. XLIV, fig. 15)

**Staurastrum excavatum** W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 78, 1895; Journ. Linn. Soc. Bot. 39, 71, 1909; ALLORGE Rev. Alg. 5, 364, 1930.

Cellulae parvae, leviter longiores quam latiores sine processibus, paullo constrictae, sinu acuminato ad verticem; semicellulae subrectangulares, lateribus inflatis, apicibus excavatis, angulis in processus longos nodulosos divergentes leviter attenuatos in apice minute trispinatos productis; a vertice visae biradiatae, oblongae, angulis in processus rectos attenuatos nodulosos productis. Long. 21  $\mu$ , Lat. cum proc. 31  $\mu$ , Lat. isth. 5  $\mu$ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Benten-numa, Tomakomai in Iburi. **Hondo**: Ôishita in Uzen. (New to Japan) (Pl. XLIV, fig. 18)

Distr. Central Asia, Africa, Madagascar, Australia.

var. **minimum** BERNARD in Dep. agr. Indes. Néerl. pl. 5, f. 120, 121, 1909.

Cellulae minores quam in forma typica. Long. sine proc. 10.8  $\mu$ , cum proc. 21.5  $\mu$ , Lat. cum proc. 32.3  $\mu$ , Lat. isth. 4.3  $\mu$ .

Hab. **Hokkaido**: Shizukari in Oshima. (New to Japan) (Pl. XLIV, fig. 17)

Distr. Java.

var. **planctonicum** KRIEG. in Arch. Hydrobiol. suppl. 11, 198, 1932.

Var. apicibus cellularum in medio non concavis nec rotundis, sinu in extremo acutangulo. Long. sine proc. 19.6  $\mu$ , cum proc. 30–31  $\mu$ , Lat. cum proc. 50–51  $\mu$ , Lat. isth. 8.4  $\mu$ .

Hab. **Hokkaido**: Ko-numa in Oshima. **Hondo**: Ikejiri-ike in Tanba. (New to Japan) (Pl. XLIV, fig. 19)

Distr. Java, Sumatra.

**Staurastrum Johnsonii** W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 266, 1896; SMITH Wisc. Bull. 57, 104, 1924; OKADA Journ. Imp. Fish. Inst. 30, 184, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 192, 1935.

Cellulae mediocres, circiter  $1\frac{1}{2}$  longiores quam latae, profunde constrictae, sinu aperto et paene rectangulari; semicellulae campanulatae, marginibus lateralibus inflatis et verrucosis cum serie verrucarum emarginatarum leviter irregulariter praeditis, apicibus convexis in seriebus transversis verrucarum 4-6 emarginatarum et seriebus verrucarum similarum infra apicem praeditis, angulis apicalibus productis in processus longos attenuatos denticulatos horizontaliter directos cum apicibus minute trispinatis; a vertice visae ellipticae, lateribus cum seriebus verrucarum emarginatarum intra marginem utrobique praeditis, polis productis in processus longos rectos denticulatos cum apicibus trispinatis. Long. 32-36.4  $\mu$ , Lat. cum proc. 50-60  $\mu$ , Lat. isth. 7-8  $\mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi. **Hondo**: Nogiwano-kwannon-ike, Akai in Iwashiro; Okemi-ike in Shinano. (New to Asia) (Pl. XLIV, fig. 22)

Distr. Kuriles, arctic Canada, U. S. A.

**Staurastrum karasuensis** HIRANO in Act. Phytotax. Geobot. 14, 2, 1949.

Cellulae parvae, leviter longae quam latae sine processibus, profunde constrictae, sinu excavato, isthmo elongato et torto; semicellulae aliquando cyathiformes, angulis basalibus leviter obtusis, apice leviter concavato, angulis apicalibus in processus tenues divergentes longos multo nodulosos et in apice leviter dilatatos et minute trispinatos productis; a vertice visae oblongae, polis in processus productis. Long. cum proc. 43  $\mu$ , Lat. cum proc. 28  $\mu$ , Lat. isth. 2.2  $\mu$ .

Hab. **Hondo**: Karaso-numa in Ugo. (Pl. XLIV, fig. 11)

Distr. Japan.

**Staurastrum natator** WEST in WEST & CARTER Monogr. Brit. Desm. 5, 149, 1923; TAYLOR Pap. Mich. Acad. Sci. 20, 194, 1935; OKADA ASAHINA'S Inkwa. 177, 1939.

Cellulae mediocres, circiter  $1\frac{1}{2}$  duplo latiores quam longiores cum processibus, modice constrictae, sinu late aperto sed acuminato ad verticem; semicellulae obverse triangulares, marginibus lateralibus leviter tumidis, apicibus leviter convexis et evidenter 3 crenulato-undulatis, crenis omnibus spina minuta ordinatis, angulis apicalibus productis in processus longos divergentes multo nodulatos in apice truncato et minute trispinatos, corpore semicellulae protuberantia rotunda infra apicem ordinata, protuberantibus compositis in annulo granulorum 6 irregulariter, in parte basali semicellulae cum granulis irregulariter ordinatis; semicellulae a latere visae paene circulares, lateribus in medio utrobique cum protuberantia mediana, processibus projectis inter duobus verrucis apicalibus; cellulae a vertice visae rhomboides, lateribus cum protuberantia mediana utrobique, polis elongatis et productis in

processus longos, corporis semicellularum cum duobus 3 emarginato-verrucarum intra marginem utrobique. Long.  $53\mu$ , Lat. cum proc.  $64\mu$ , Lat. isth.  $11\mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi. (New to Asia) (Pl. XLIV, fig. 20)

Distr. N. Kuriles, Siberia, British Isles, Scandinavia, New Foundland, arctic Canada.

**Staurastrum inflexum** BRÉB. in WEST & CARTER Monogr. Brit. Desm. 5, 108, 1923; HIRANO Act. Phytotax. Geobot. 12, 162, 1943.

Cellulae parvae, circiter  $1\frac{1}{2}$  latiores quam longiores cum processibus, profunde constrictae, sinu aperto et acutangulo ad verticem; semicellulae subcuneatae, marginibus ventralibus leviter convexis, apice late et leviter convexo, angulis lateralibus in processus longos gracillimos leviter inflexos spinulosos cum 4 seriebus denticulorum concentricis productis, apicibus processuum minute trispinatis, cum seriebus transversis denticulorum juxta et supra isthmum; a vertice visae triangulares, lateribus concavis, angulis productis in processus longos gracillimos et apicibus minute trispinatis, marginibus processuum denticulatis. Long.  $28-34\mu$ , Lat. cum proc.  $36-42\mu$ , Lat. isth.  $7.4-9\mu$ .

Hab. **Hokkaido**: Kumoigahara of Mt. Daisetsu in Ishikari; Tomakomai in Iburi; Junsai-akanuma in Oshima. **Hondo**: Chûkawa-ike in Uzen; Kagami-ishi-mura in Iwashiro; Kurosawano-ike of Mt. Myoko in Echigo; Kazafuki-ike in Shinano; Takashihara in Mikawa; Nukigawa, Mt. Hira in Oomi. (Pl. XLIII, fig. 9)

Distr. Japan, whole Europe, arctic Canada.

**Staurastrum Sebaldi** REINSCH in WEST Journ. Roy. Micr. Soc. 5, 1889 (reprint); MIGULA Krypt. Fl. II, 547, 1907; WEST & CARTER Monogr. Brit. Desm. 5, 166, 1923.

Cellulae magnae, leviter latiores quam longiores sine spinis, modice constrictae, sinu aperto extremo acuminato; semicellulae cyathiformes, marginibus dorsalibus convexis, angulis apicalibus in processus breves denticulatos robustos attenuatos horizontaliter vel leviter convergente-directos in apice 3-4 spinatos productis, processibus cum seriebus concentricis valide denticulorum ordinatis, apicibus semicellularum cum serie valida simplici denticulorum aliquando 2-3 dentatis in apice, serie simili denticulorum juxta infra apicem, seriebus inferioribus denticulorum variabilibus aliquando nullis; a vertice visae trigonae, lateribus paene rectis, angulis in processus breves denticulatos attenuatos productis, apicibus processuum spinis 3-4 praeditis, lateribus cum serie simplici vel complexa denticulorum intra marginem unumquemque. Long. sine spin.  $67-75.6\mu$ , cum spin.  $84\mu$ , Lat. cum spin.  $67-92\mu$ ,



Lat. isth. 16.8–19.5  $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Shimoyûbetsu, Nikuru-numa in Kitami, Moseushi in Ishikari. (New to Japan) (Pl. XLVIII, fig. 7, 8, Pl. XLIX, fig. 1, 2)

Distr. Manchuria, India, whole Europe, Faeroes, Greenland, Australia.

var. **gracile** MESSIK. in Viertelj. Naturf. Ges. Zurich 72, 347, 1927; l. c. 28, 211, 1928.

Cellulae minores quam in forma typica, cellulae leviter depressae; in vertice visae seriebus verrucarum emarginatarum intra marginem lateralem praeditis. Long. 29.4–31  $\mu$ , Lat. cum proc. 39–44.8  $\mu$ , Lat. isth. 14–14.7  $\mu$ .

Hab. **Hondo**: Ishigaki-ike in Ise. (New to Asia) (Pl. XLIV, fig. 23)

Distr. Switzerland.

*Staurastrum Sebaldi* var. *gracile* from the pond Ishigaki coincides with MESSIKOMMER's form in Switzerland in membrane marking and general outline of semicell, and the nature of convergent processes, however, is smaller than his dimension.

var. **ornatum** NORDST. in Act. Univ. Lund. 9, 34, 1873; WEST & CARTER Monogr. Brit. Desm. 5, 167, 1923; HIRANO Act. Phytotax. Geobot. 15, 56, 1953.

Var. semicellulae plus inflatae ad basim, processibus plus longioribus et angustioribus, in parte basali processuum cum seriebus emarginato-verrucarum in margine dorsali et ventrali, semicellulis in parte basali juxta supra sinum cum verrucis ordinatis. Long. 60  $\mu$ , Lat. cum proc. 90  $\mu$ , Lat. isth. 15  $\mu$ .

Hab. **Hokkaido**: Shimoyûbetsu in Kitami. **Hondo**: Lake Biwa in Oomi. (Pl. XLVII, fig. 6, 7)

Distr. Japan, Europe, New Zealand, Australia.

var. **productum** W. & G. S. WEST in Trans. Roy. Soc. Edingh. 12, 504, 1905; WEST & CARTER Monogr. Brit. Desm. 5, 168, 1923; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 56, 1953.

Cellulae longiores quam in forma typica, circiter duplo-longiores quam latae sine processibus, apicibus convexis et glabris, processibus longis verrucosis; a vertice visae 4-gonae, lateribus paene rectis et glabris, verrucis quaternis emarginatis juxta intra marginem. Long. 52  $\mu$ , Lat. sine proc. 26  $\mu$ , cum proc. 65  $\mu$ , Lat. isth. 15  $\mu$ .

Hab. **Hondo**: Lake Biwa in Oomi. (Pl. XLVII, fig. 8, 9)

Distr. Japan, British Isles, Finland.

*Staurastrum subtilissimum* HIRANO in Act. Phytotax. Geobot 14, 2, 1949.

Cellulae parvae, leviter longae quam latae sine processibus, modice const-

rietae, sinu late aperto et leviter acuminato; semicellulae cuneatae, marginibus ventralibus leviter tumidis, apicibus leviter convexis, angulis apicalibus in processus longos gracillimos glabros divergentes non attenuatos in apice leviter dilatatos et truncatos productis; a vertice visae 4-gonae, lateribus paene rectis, angulis in processus longos gracillimos in apice dilatatos productis. Long. sine proc.  $11.8\ \mu$ , cum proc.  $25.2\ \mu$ , Lat. sine proc.  $8.4\ \mu$ , cum proc.  $30.8\ \mu$ , Lat. isth.  $5\ \mu$ .

Hab. **Hondo**: Ukishima-ônuma in Uzen. (Pl. XLIV, fig. 25, 26)

Distr. Japan.

**Staurastrum micron** WEST in Bot. Tidskr. 24, 179, 1901; WEST & CARTER Monogr. Brit. Desm. 5, 123, 1923; HUBER-PESTALOZZI Arch. Hydrobiol. 20, 425, 1929; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 53, 1935; HIRANO Bot. Mag. 66, 207, 1953.

Cellulae minutae, leviter latiores quam longiores cum processibus, profunde constrictae, sinu aperto acutangulo; semicellulae subtriangulares, apicibus rectis vel leviter convexis, angulis superioribus productis in processus breves robustos divergentes attenuatos cum apicibus truncatis et tribus spinis brevibus, processibus seriebus duabus spinarum brevium ad basis processus ornatis; a vertice visae trigonae, lateribus concavis, angulis productis in processus breves in margine biundulatos et apicibus processuum trispinatis. Long. cum proc.  $15.4$ – $16.8\ \mu$ , Lat. cum proc.  $15.4$ – $18\ \mu$ , Lat. isth.  $5.6$ – $6\ \mu$ .

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi; Kamikoshi-ukishimahara in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu; Ôyachi of Mt. Hachimantai, Mt. Kurikoma in Rikuchû; Mt. Gassan in Uzen; Izu-numa in Rikuzen; Ozegahara in Kôzuke; Mt. Naeba in Echigo; Mt. Tateyama, Tarobei-daira in Etchû; Happo-ridge, Shigakôgen in Shinano. (Pl. XLIV, fig. 8)

Distr. Japan, British Isles, Sweden.

var. **unidentatum** HIRANO, var. nov.

Var. processibus unidentatis et horizontaliter productis. Long.  $15.4\ \mu$ , Lat. cum proc.  $19.6\ \mu$ , Lat. isth.  $5.6\ \mu$ .

Hab. **Hondo**: Shira-ike in Shinano. (Pl. XLIV, fig. 9)

**Staurastrum acestrophorum** W. & G. S. WEST in Trans. Linn. Soc. Bot. 6, 184, 1902; HIRANO Jap. Journ. Bot. 14, 229, 1954.

Cellulae parvae, circiter  $1\frac{1}{2}$  duplo latiores quam longiores cum processibus, profunde constrictae, sinu aperto et acutangulo vel rectangulari ad verticem leviter acuminato; semicellulae late campanulatae, apice leviter convexo, angulis lateralibus in processibus brevibus gracillimis trinodulosis horizontaliter vel paullo subdivergentis productis, apicibus trispinatis, margini-

bis superioribus processuum cum denticulis conicis et marginibus inferioribus cum spinis brevibus paucis, apicibus semicellularum rectis vel leviter convexis; a vertice visae 4-angulatae, lateribus concavis, angulis productis in processibus gracillimis nodulosis cum utrobique marginibus lateralibus denticulis duobus ad basim, apicibus processuum trispinatis. Long. cum proc. 20-21  $\mu$ , Lat. cum proc. 23-24  $\mu$ , Lat. isth. 7  $\mu$ .

Hab. **Hondo**: Suiren-numa on Mt. Hakkoda in Mutsu. (Pl. XLIV, fig. 16)  
Distr. Japan, Ceylon.

**Staurastrum paradoxum** MEYEN in RALFS Brit. Desm. 138, 1848; WOLLE Desm. U. S. 129, 1884; ROY & BISSET Journ. Bot. 24, 239, 1886; NORDSTEDT K. Sv. Vet. Akad. Handl. 22, 38, 1888; TURNER l. c. 25, 125, 1893; WEST Journ. Linn. Soc. Bot. 35, 548, 1903; WEST & CARTER Monogr. Brit. Desm. 5, 101, 1923; SMITH Wisc. Bull. 57, 85, 1924; TAYLOR Pap. Mich. Acad. Sci. 20, 195, 1935; HIRANO Act. Phytotax. Geobot. 14, 140, 1952; l. c. 14, 167, 1952.

Cellulae parvae vel modicae, circiter 1½-2 longiores quam latae sine processibus, profunde constrictae, sinu aperto acutangulo; semicellulae cyathiformes, marginibus ventralibus convexis, apicibus leviter convexis, angulis superioribus productis in processus longos divergentes nodulosos cum apicibus trispinatis; a vertice visae 3-4-gonae, lateribus rectis vel leviter concavis, angulis productis in processus longos leviter attenuatos denticulatos cum apicibus spinatis; in centro apicis semicellularum glabrae, seriebus granulorum minorum intra marginem lateralem uniuscuiusque ornatae. Long. sine proc. 14-28  $\mu$ , cum proc. 33-69  $\mu$ , Lat. sine proc. 10-18  $\mu$ , cum proc. 36-65  $\mu$ , Lat. isth. 4-6.5  $\mu$ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Shizukari in Oshima. **Hondo**: Kariwano in Ugo; Bagyu-numa in Iwaki; Oze-numa in Kôzuke; Tokyo in Musashi; Kitaura in Hitachi; Kamaga-ike of Otari, Lakes Nojiri, Suwa, Matsubara, Kizaki, Nakatsuna, Awoki in Shinano; Lakes Saino-ko, Yamanaka, Ashino-ko in Kai; Lake Biwa in Oomi. **Kiushiu**: Unagi-ike in Satsuma. (Pl. XLV, fig. 5-8)

Distr. Japan, Siberia, S. China, Turkey in Asia, whole Europe, Iceland, Faeroes, Greenland, N. & S. America, Australia, S. Africa.

var. **parvum** WEST in WEST & CARTER Monogr. Brit. Desm. 5, 106, 1923; SMITH Wisc. Bull. 57, 87, 1924; PRESCOTT Pap. Mich. Acad. Sci. 25, 94, 1940; PRESCOTT & SCOTT Trans. Amer. Micr. Soc. 61, 23, 1942; HIRANO Act. Phytotax. Geobot. 14, 140, 1952.

Cellulae minores, sed ceteris similes, processibus gracillimis et in seriebus concentricis circa quaternis denticulorum ornatis. Long. sine proc. 11-14  $\mu$ , cum proc. 16.8-28  $\mu$ , Lat. cum proc. 21-36  $\mu$ , Lat. isth. 5.6-7.6  $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Tôtsuru-ko in Kitami; Kumoiga-

hara of Mt. Daisetsu in Ishikari; Shizukari, Junsai-numa, Junsai-akanuma in Oshima. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu; Karaso-numa in Ugo; Kôriyama in Iwashiro; Ozegahara in Kôzuke; Tokyo in Musashi; Mt. Kirigamine in Shinano; Shôji-ko in Kai; Takashihara, Ônuma in Mikawa; Fuse-ike in Oomi; Sawano-ike, Takaraga-ike in Yamashiro. **Kiushiu**: Naka-hara-ike in Satsuma. (Pl. XLV, fig. 11)

Distr. Japan, S. China, Europe, U.S.A.

var. **longipes** NORDST. in BERGE Bot. Notis. 6, 1900; MIGULA Krypt. Fl. II, 552. 1907; WEST & CARTER Monogr. Brit. Desm. 5, 103, 1923; ALLORGE Rev. Alg. 5, 366, 1930.

Var. processibus multo longioribus et circiter  $1\frac{1}{2}$ -longioribus quam in longitudinis corporis, non attenuatis, gracillime incurvatis. Long. sine proc.  $25.2\ \mu$ , cum proc.  $70\ \mu$ , Lat. sine proc.  $16.8\ \mu$ , cum proc.  $70\ \mu$ , Lat. isth.  $7.8\ \mu$ .

Hab. **Hondo**: Kitaura in Hitachi. (New to Japan) (Pl. XLVI, fig. 8)

Distr. Central China, Turkey, whole Europe, Iceland, Canada, Australia.

var. **nodulosum** WEST in WEST & CARTER Monogr. Brit. Desm. 5, 106, 1923.

Cellulae minores, apicibus processuum trifurcatis; in vertice visae triangulares, lateribus duobus medio undulatis ordinatis. Long.  $25\ \mu$ , Lat. cum proc.  $39\ \mu$ , Lat. isth.  $7\ \mu$ .

Hab. **Hondo**: Kôriyama in Iwashiro. (New to Asia) (Pl. XLV, fig. 10)

Distr. British Isles.

**Staurastrum dentatum** KRIEGER in Arch. Hydrobiol. suppl. 11, 197, 1932.

var. **gracilis** HIRANO, var. nov.

Semicellulae sine spinis basalibus supra isthmum, processibus multo et delicate undulatis, apice processuum paullo dilatato. Long. sine proc.  $14\ \mu$ , cum proc.  $22.4\ \mu$ , Lat. cum proc.  $28\ \mu$ , Lat. isth.  $6\ \mu$ .

Hab. **Hokkaido**: Minenobu in Ishikari. **Hondo**: Kamaga-ike of Mt. Kirigamine in Shinano. (Pl. XLIV, fig. 21)

**Staurastrum dorsidentiferum** W. & G.S. WEST var. **ornatum** GRÖNBL. in Bot. Notis. 60, 1938; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 58, 1953.

Cellulae minores quam in forma typica, in fronte visae cum serie transversali denticulorum supra isthmum; in vertice visae lateribus cum seriebus emarginatis granulorum intra marginem unumquemque. Long. cum proc.  $47-94\ \mu$ , sine proc.  $43-58\ \mu$ , Lat. cum proc.  $90-103\ \mu$ , sine proc.  $19-24\ \mu$ , Lat. isth.  $11-13\ \mu$ .

Hab. **Hokkaido**: Lake Akan in Kushiro. **Hondo**: Lake Biwa in Oomi. (Pl. XLV, fig. 1-3)

Distr. Japan, Finland.

**Staurastrum gracile** RALFS in Brit. Desm. 136, 1848; WOLLE Desm. U. S. 133, 1884; WEST Journ. Linn. Soc. Bot. 33, 317, 1898; l.c. 35, 549, 1903; HIGASHI in OKAMURA's Nipp. Sorui Meii 280, 1916; WEST & CARTER Monogr. Brit. Desm. 5, 96, 1923; SMITH Wisc. Bull. 57, 88, 1924; ALLORGE Rev. Alg. 5, 364, 1930; KRIEGER Arch. Hydrobiol. suppl. 11, 199, 1932; OKADA Journ. Imp. Fish. Inst. 30, 183, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 191, 1935; MESSIKOMMER Hedw. 78, 165, 186, 1938.

Cellulae variabiles, generaliter parvae vel mediocres, circiter duplo longiores quam latiores sine processibus, paullo constrictae, sinu acuto; semicellulae variabiles mensura et forma, generaliter cyathiformes, angulis inferioribus rotundis, marginibus superioribus paene verticalibus et leviter divergentibus convexisque, angulis superioribus in processus longos attenuatos graciles generaliter horizontales vel leviter convergentes ad marginem cum seriebus denticulorum productis, longitudo processuum variabilis et cum apicibus cum 3-4 spinis minutis; a vertice visae 3-4-gonae, lateribus rectis vel leviter concavis, angulis productis in processus longos attenuatos, cum seriebus granulorum aliquando duobus ab granulo ad angulum intra marginem lateralem. Long. cum proc. 28-47  $\mu$ , Lat. cum proc. 39-77  $\mu$ , Lat. isth. 8.4-11  $\mu$ .

Hab. **Hokkaido**: Nikuru-numa in Kitami; Toyokoro in Tokachi; Horomui, Nakano of Sapporo in Ishikari; Shizukari in Oshima. **Hondo**: Ôishita, Chûkawa-ike in Uzen; Izu-numa in Rikuzen; Jiuemon-ike in Kôzuke; Kitaura in Hitachi; Ashinota-ike, Kanori-ike in Shinano; Ônuma in Mikawa; Toba in Ise; Matsubara-naiko, Fuse-ike, Lake Biwa in Oomi; Mizoroga-ike, Ariga-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Yamada in Tosa; Dôgo in Iyo. (Pl. XLIV, fig. 30, Pl. XLV, fig. 4)

Distr. Japan, Kuriles, Korea, Mongolia, Siberia, China, Ceylon, Java, Sumatra, Bali, Turkey in Asia, whole Europe, Greenland, N. & S. America, Australia, Africa.

var. **subtenuissimum** WORONICHIN in MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 52, 1935; HIRANO Jap. Journ. Bot. 14, 230, 1954.

Cellulae parvae, circiter tam longae quam latae vel plus latiores, sinu angusto et acuto ad verticem, processibus convergentibus cum seriebus tribus acutis granulorum, apicibus semicellularum leviter concavis. Long. 20-22  $\mu$ , Lat. 25-30  $\mu$ , Lat. isth. 4-5.6  $\mu$ .

Hab. **Hokkaido**: Moseushi in Ishikari. **Hondo**: Koke-numa in Ugo; Ôyachi of Mt. Hachimantai in Rikuchû; Eboshi-numa in Uzen; Mt. Azuma, Akai in Iwashiro; Oze, Ômine-numa in Kôzuke; Kazafuki-kaminota, Mt. Kirigamine in Shinano; **Shikoku**: Shiramizu-pass of Matsuyama in Iyo. (Pl. XLIV, fig. 27)

Distr. Japan, Caucasus, Switzerland.

var. **coronulatum** BOLDT in KAISER Krypt. Forsch. 1, 257, 1919; WEST & CARTER Monogr. Brit. Desm. 5, 100, 1923.

Cellulae parvae, processibus brevioribus, apicibus semicellularum leviter convexis, processibus quaternis breve emarginatis praeditis; a vertice visae triangulares, duabus verrucis emarginatis intra marginem ad centrum lateris uniuscuiusque. Long. 26-28  $\mu$ , Lat. cum proc. 34-41  $\mu$ , Lat. isth. 6.5-10  $\mu$ .

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi; Tomakomai in Iburi.  
**Hondo**: Izu-numa in Rikuzen. (New to Japan) (Pl. XLIV, fig. 24)

Distr. Siberia, British Isles, Germany, Latvia.

var. **ornatum** KRIEGER in Arch. Hydrobiol. suppl. 11, 200, 1932.

Var. in vertice visae lateribus cum verrucis duabus in medio intra marginem uniuscuiusque. Long. 38.7  $\mu$ , Lat. cum proc. 62.4  $\mu$ , Lat. isth. 13  $\mu$ .

Hab. **Hondo**: Shinohara-ike in Oomi. (New to Japan) (Pl. XLV, fig. 9)

Distr. Sumatra.

**Staurastrum pentacrinum** KRIEGER var. **trisetum** HIRANO in Act. Phytotax. Geobot. 14, 4, 1949.

Cellulae in vertice visae 6-angulares, processibus undulatis et in apice minute trispinatis. Long. 28  $\mu$ , Lat. cum proc. 60  $\mu$ , Lat. isth. 10  $\mu$ .

Hab. **Hokkaido**: Lake Tôro in Kushiro. (Pl. XLIV, fig. 28, 29)

Distr. Japan.

**Staurastrum cingulum** (W. & G.S. WEST) G.M. SMITH var. **inflatum** HIRANO  
*Staurastrum paradoxum* MEYEN var. *inflatum* HIRANO in Act. Phytotax. Geobot. 14, 140, 1952.

Cellulae minores quam in forma typica, processibus brevioribus, divergentibus sed interdum subdivergentibus, distincte 5-9 denticulatis, apicibus semicellularum paene rectis vel paullo convexis. Long. sine proc. 19.4-21.5  $\mu$ , cum proc. 25.8  $\mu$ , Lat. cum proc. 38.7  $\mu$ , Lat. isth. 6.5  $\mu$ .

Hab. **Hondo**: Tokyo in Musashi; Lake Ashi in Sagami. (Pl. XLVI, fig. 4)

Distr. Japan.

**Staurastrum longistipes** HIRANO in Act. Phytotax. Geobot. 14, 3, 1949.

Cellulae submediocres, circiter duplo longiores quam latiores sine processibus, modice constrictae, sinu late aperto et leviter acuminato ad verticem; semicellulae aliquando campanulato-cuneatae, marginibus lateralibus inferioribus leviter tumidis, apicibus leviter convexis, angulis apicalibus in processus longos gracillimos glabros leviter dilatatos subhorizontaliter productis, apici-

bus processuum truncatis et acute trispinatis; a vertice visae 4-gonae, lateribus concavis, angulis in processus longos gracillimos productis, processibus gradatim dilatatis ad apicem; membrana glabra. Long. sine proc.  $22.4\ \mu$ , cum proc.  $33.6\ \mu$ , Lat. cum proc.  $56\ \mu$ , Lat. isth.  $8.6\ \mu$ .

Hab. Hondo: Ôishitano-junsai-tsutsumi in Uzen. (Pl. XLVI, fig. 6)

Distr. Japan.

var. **nodulosum** HIRANO in Act. Phytotax. Geobot. 14, 38, 1950.

Var. processibus nodulosis. Long. sine proc.  $21\ \mu$ , cum proc.  $36.4\ \mu$ , Lat. sine proc.  $14\ \mu$ , cum proc.  $53\ \mu$ , Lat. isth.  $7\ \mu$ .

Hab. Hondo: Akaiyachi in Iwashiro. (Pl. XLVI, fig. 7)

Distr. Japan.

**Staurationstrum asterias** NYGAARD in KRIEGER Arch. Hydrobiol. suppl. 11, 193, 1932.

Cellulae submediocres, circiter  $1\frac{1}{2}$  latiores quam longiores vel leviter plus latiores, modice constrictae, sinu late aperto et acutangulo ad apicem; semicellulae subquadratae, dilatatae ad apicem, apicibus leviter convexis spinis minutis praeditis, marginibus lateralibus leviter tumidis, angulis apicalibus productis in processus longos leviter divergentes (aliquando horizontalibus) attenuatos margini cum serie 4-5 denticulorum et apicibus circa 3 spinis minutis praeditis; semicellulae cum seriebus annularibus transversis denticulorum in isthmum; a vertice visae 6-gonae, processibus denticulato-nodulosis et leviter attenuatis versus apicem, apicibus semicellularum cum uno annulo 12 denticulorum. Long.  $31-34\ \mu$ , Lat. cum proc.  $45-50\ \mu$ , Lat. isth.  $11\ \mu$ .

Hab. Hokkaido: Tomakomai in Iburi. Hondo: Fuse-ike in Oomi. (New to Japan) (Pl. XLV, fig. 12)

Distr. Java.

var. **divergens** HIRANO, var. nov.

Cellulae sine seriebus transversis denticulorum in isthmum, processibus divergentibus. Long. sine proc.  $28\ \mu$ , cum proc.  $30\ \mu$ , Lat. cum proc.  $47\ \mu$ , Lat. isth.  $10.7\ \mu$ .

Hab. Hondo: Lake Kawaguchi in Kai. (Pl. XLVI, fig. 5)

**Staurationstrum longiradiatum** W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 267, 1896; SMITH Wisc. Bull. 57, 90, 1924; PRESCOTT Univ. Iowa Stud. 13, 136, 1931; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 59, 1953.

Cellulae modicae, circiter  $1\frac{3}{8}$  latiores quam longiores cum processibus, modice constrictae, sinu paene rectangulari, sed acuto ad extremum; semi-

cellulae campanulatae, parte basali inflato, apice paullo convexo et cum serie emarginata verrucarum, angulis apicalibus in processus longos attenuatos denticulatos horizontaliter vel paullo convergentes directis, in apice truncatos et acute trispinatos, in margine superiore processuum profunde crenulatos et cum serie prominente denticulorum ordinatos, in margine inferiore vadoso crenulatos productis, processibus cum serie denticulorum intra marginem lateralem processuum; in basi semicellularum cum verruca bidenticulata juxta supra sinum utrobique; a vertice visae trigonae, lateribus concavis cum serie emarginato-verrucae intra marginem unumquemque, angulis in processus longos attenuatos nodulosos productis; in basi visae partibus basalibus semicellularum rotundo-triangularibus, angulis rotundis aliquantum cum verrucis duabus conicis. Long. cum proc.  $43\ \mu$ , Lat. cum proc.  $73\ \mu$ , Lat. isth.  $7\ \mu$ .

Hab. **Hokkaido**: Lake Akan in Kushiro. **Hondo**: Lake Biwa in Oomi. (Pl. XLVI, fig. 1, 2)

Distr. Japan, Ceylon, Africa. U.S.A.

var. **breviradiatum** GRÖNBLAD in Act. Soc. Faun. Flor. Fenn. 47, 68, 1920.

Var. semicellulae cum processibus relative brevioribus, processibus subhorizontalibus vel leviter divergentibus, marginibus lateralibus cum granulis tribus supra sinum. Long. sine proc.  $47.6\ \mu$ ; cum proc.  $50\ \mu$ , Lat. cum proc.  $70\ \mu$ , Lat. isth.  $11\ \mu$ .

Hab. **Hondo**: Tamaru in Ise. (New to Asia) (Pl. XLVII, fig. 4)

Distr. Finland.

**Staurastrum oxyacanthum** ARCHER in MIGULA Krypt. Fl. II, 546, 1907; WEST & CARTER Monogr. Brit. Desm. 5, 169, 1923; GISTL Krypt. Forsch. 1, 473, 1926; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 73, 210, 1928; HOMFELD Pflanzenf. 12, 80, 1929.

Cellulae submediocres, circiter  $1\frac{1}{2}$  latiores quam longiores cum processibus, profunde constrictae, sinu acuto aperto, extrorsum paene rectangulares; semicellulae subcuneatae vel aliquando campanulatae, marginibus lateralibus inferioribus tumidis, apicibus convexis spinis duabus prominentibus utrobique instructis, angulis apicalibus in processus longos attenuatos denticulatos leviter convergentes productis, apicibus processuum acute trispinatis et in margine lateris processuum serie 4-5 concentricis denticulorum instructis, cum serie transversali denticulorum trans basin semicellulae; a vertice visae trigonae, lateribus rectis et glabris, spinis duabus prominentibus erectibus intra marginem unumquemque projectis, angulis in processus longos denticulatos productis. Long.  $39\ \mu$ , Lat. cum proc.  $58-59\ \mu$ , Lat. isth.  $11\ \mu$ .

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi; Tomakomai in Iburi.



(New to Japan) (Pl. XLVI, fig. 10)

Distr. Mongolia, Siberia, Europe, Faeroes, Greenland.

**Staurastrum pseudosebaldi** WILLE in WEST & CARTER Monogr. Brit. Desm. 5, 113, 1923; PRESCOTT Pap. Mich. Acad. Sci. 25, 94, 1940.

Cellulae mediocres, leviter latiores quam longiores cum processibus, paullo constrictae, sinu aperto acutangolo; semicellulae subcampanulatae, sursum dilatatae, marginibus lateralibus leviter concavis, apicibus convexis cum seriebus spinis bifidis ordinatis, angulis apicalibus in processus longos denticulatos leviter incurvatos productis, extremitatibus acute trispinatis, partibus basalibus semicellularum cum seriebus transversalibus denticulorum; a vertice visae triangulares, lateribus concavis seriebus emarginato-spinarum leviter projectis in ambitu marginis (circa 6 in cuiusque latere) et seriebus similiter emarginato-spinarum intra marginem, angulis in processus attenuatos nodulosos in apice trispinatos acutos productis. Long.  $39\ \mu$ , Lat.  $50.4\ \mu$ , Lat. isth.  $11\ \mu$ .

Hab. **Hokkaido**: Minenobu in Ishikari. **Hondo**: Chûkawa-ike in Uzen. (New to Japan) (Pl. XLVI, fig. 12)

Distr. India, Europe, Faeroes.

var. **simplicius** WEST in MIGULA Krypt. Fl. II, 549, 1907; WEST & CARTER Monogr. Brit. Desm. 5, 114, 1923; DICK Mitt. Pfälz Ver. Nat. Pollichia 3, 140, 1930.

Cellulae parvae, apicibus spinis simplicibus, processibus brevibus cum apice trispinato, cum spinis raro longioribus. Long.  $32.3\ \mu$ , Lat. cum proc.  $51\text{--}52\ \mu$ , Lat. isth.  $8.6\ \mu$ .

Hab. **Kiushiu**: Nakahama of Lake Ikeda in Satsuma. (New to Japan) (Pl. XLVI, fig. 9)

Distr. England, Germany.

**Staurastrum elegantissimum** JOHNSON in Bull. Torrey Bot. Club 21, 290, 1894.

Cellulae mediocres, circiter  $1\frac{1}{2}$  duplo latiores quam longiores cum processibus, leviter constrictae, sinu aperto et extremo rectangulari; semicellulae campanulatae, leviter dilatatis ad apicem, angulis basalibus bene rotundis, marginibus lateralibus leviter concavis in parte superiore et convexis in parte inferiore, apice leviter convexo, angulis apicalibus in processus longos graciles attenuatos denticulatos leviter incurvatos productis, apicibus trispinatis, spinis brevibus et acutis, processibus cum unica serie transversa denticulorum a basi ad apicem, et seriebus transversis duabus denticulorum infra apicem semicellularum, cum unico annulo transverso denticulorum ad basim semicellulae; a vertice visae quadrangulares, lateribus concavis, angulis productis

in processus longos graciles attenuatos validos denticulatos cum apicibus acutis trispinatis, lateribus cum spinis brevibus bifurcatis et seriebus denticulorum bifurcatorum intra marginem. Long. 45–48  $\mu$ , Lat. cum proc. 45–50  $\mu$ , Lat. isth. 11–13  $\mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. **Hondo**: Izu-numa in Rikuzen; Gôno-ike in Hitachi; Tanuki-numa in Suruga; Matsubara-naiko, Nukigawa in Oomi; Mizoroga-ike, Ariga-ike, Rokujizo in Yamashiro; Ikejiri-ike in Tanba. **Kiushiu**: Nakahama of Lake Ikeda in Satsuma. (New to Asia) (Pl. XLVI, fig. 11)  
Distr. U.S.A.

**Staurastrum zonatum** BÖRGES, var. **ceylanicum** W. & G. S. WEST forma **convergens** KRIEGER in Arch. Hydrobiol. suppl. 11, 210, 1932.

Forma processibus horizontaliter vel leviter deorsum directis. Long. 30–31  $\mu$ , Lat. 30–31  $\mu$ , Lat. isth. 9.7  $\mu$ .

Hab. **Hokkaido**: Moere-numa of Sapporo in Ishikari. **Hondo**: Ôishita in Uzen; Mt. Kirigamine in Shinano. (New to Japan) (Pl. XLVIII, fig. 9, 10)  
Distr. Sumatra.

var. **emarginatum** HIRANO, var. nov.

Cellulae cum serie dorsali et ventrali denticulorum ad et infra apicem, granulis emarginatis ad medium, processibus horizontalibus; cellulae in vertice visae 4-gonae, lateribus denticulis emarginatis ad medium et serie denticulorum in medio marginis intra marginem unumquemque. Long. 36–37  $\mu$ , Lat. 36  $\mu$ , Lat. isth. 12  $\mu$ .

Hab. **Hondo**: Kotsutsumi-nishi-ike in Mikawa. (Pl. XLVII, fig. 13, 14)

**Staurastrum Arachne** RALFS in Brit. Desm. 136, 1848; WOLLE Desm. U. S. 129, 1884; ROY & BISSET Journ. Bot. 24, 239, 1886; WEST & CARTER Monogr. Brit. DESM 5, 151, 1923; DICK Bot. Arch. 3, 226, 1923; SMITH Wisc. Bull. 57, 110, 1924.

Cellulae parvae, circiter duplo latiores quam longiores cum processibus, modice constrictae, sinu aperto et acutangulo; semicellulae cyathiformes, marginibus lateralibus inferioribus tumidis et convexis, apicibus leviter convexis vel paene rectis, angulis superioribus in processus longos gracillimos denticulatos horizontales vel leviter convergentes productis, apicibus processum minute trispinatis, processibus tam longis quam latis et cum granulis in serie concentricis; a vertice visae 5-gonae, lateribus concavis, seriebus granulorum acutorum intra marginem processuum; centro cum apice glabro. Long. 21–25  $\mu$ , Lat. cum proc. 36–50  $\mu$ , Lat. isth. 9.7–11  $\mu$ .

Hab. **Hokkaido**: Toyokoro in Tokachi; Shizukari in Oshima. **Hondo**: Ogata in Ugo; Ôishita in Uzen; Naga-numa, Kesho-numa in Rikuzen; Akaiyachi in Iwashiro; Oze in Kôzuke; Kotsutsumi-nishi-ike in Mikawa; Jôdo-ike, Tamaru

in Ise; Fuse-ike in Oomi; Mizoroga-ike, Takaraga-ike in Yamashiro. **Kiushiu**: Miyazaki in Hiuga. (Pl. XLVII, fig. 10)

Distr. Japan, Siberia, whole Europe, Faeroes, Greenland, U.S.A., Australia, central Africa.

var. **curvatum** W. & G. S. WEST in WEST & CARTER Monogr. Brit. Desm. 3, 152, 1923.

Cellulae in vertice visae 6-angulares, processibus leviter curvatis versus sursum, apicibus semicellularum plus convexioribus quam in forma typica. Long.  $36.6\ \mu$ , Lat. cum proc.  $64.5\ \mu$ , Lat. isth.  $11\ \mu$ .

Hab. **Hondo**: Shinohara-ike in Oomi. (New to Asia) (Pl. XLVII, fig. 11, 12)

Distr. British Isles, Norway.

**Staurastrum dimazum** (LÜTKEM.) GRÖNBL. var. **elegantius** GRÖNBL. in Act. Soc. Faun. Flor. Fenn. 47, 62, 1920.

Var. processibus longioribus, cum granulis minutis vel denticulis irregulariter ordinatis. Long.  $50.4$ – $61.6\ \mu$ , Lat.  $58.8$ – $64.4\ \mu$ , Lat. isth.  $7\ \mu$ .

Hab. **Hondo**: Nogiwano-kwannon-ike in Iwashiro. (New to Asia) (Pl. XLVII, fig. 3)

Distr. Finland, Bohemia.

**Staurastrum Duacense** W. & G. S. WEST in WEST & CARTER Monogr. Brit. Desm. 5, 116, 1923; HIRANO Journ. Jap. Bot. 20, 38, 1944.

Cellulae submediocres, circiter duplo latiores quam longiores cum processibus, modice constrictae, sinu aperto et acutangulo; semicellulae cuneatae, gradatim dilatatis versus apicem, marginibus ventralibus convevis et cum granulis minutis ad basim semicellularum, apicibus rectis cum seriebus verrucis emarginatis ad marginem, angulis apicalibus in processus longos denticulatos leviter attenuatos horizontaliter dispositos et apicibus bifidos productis, processibus aequalibus longis ad apices semicellularum, in basi processuum verrucis emarginatis ornatis et ceteris partibus denticulatis in annulis concentricis ornatis; a vertice visae ovatae vel subrhomboides, augulis in processus longos denticulatos et apicibus apiculatos productis, cum seriebus verrucis utrobique emarginatis et parallelis intra marginem processuum et sensim diminutis, ad polis denticulatis leviter curvatis exterius ornatis. Long.  $36$ – $42\ \mu$ , Lat. cum proc.  $59$ – $87\ \mu$ , Lat. isth.  $8.5$ – $11\ \mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Horomui in Ishikari; Yûfutsu, Tôasa-numa, Tomakomai in Iburi; Shizukari in Oshima. **Hondo**: Koke-numa, Nishi-numa, Hirumo-numa in Ugo; Hakuryu-ko, Ôishita, Chûkawa-ike in Uzen; Izu-numa in Rikuzen; Bagyu-numa in Iwaki; Nogiwano-kwannon-

ike, Akaiyachi in Iwashiro; Ozegahara, Jiuemon-ike in Kôzuke; Goda-numa in Shimofusa; Mt. Kirigamine, Kizaki in Shinano; Ishigaki-ike, Kanashôzu in Ise; Shinohara-ike, Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. **Shikoku**: Yamada in Tosa. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XLVII, fig. 15)

Distr. Japan, British Isles, Scandinavia.

**Staurostrum sexcostatum** BRÉB. var. **productum** WEST. in WEST & CARTER Monogr. Brit. Desm. 5, 148, 1923; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 73, 211, 1928; PRESCOTT Pap. Mich. Acad. Sci. 25, 95, 1940.

Cellulae latiores quam in forma typica, circiter tam longae quam latae vel latiores cum processibus, processibus productis et truncatis in terminali spinis 3-4 minutis ornatis, annulo granulorum acutorum in processus et annulo granulorum ad basim semicellulae; a vertice visae 5-gonae. Long. 34-42  $\mu$ , Lat. 31-53  $\mu$ , Lat. isth. 12.5-17  $\mu$ .

Hab. **Hokkaido**: Chôbushi-numa in Nemuro; Kiritappu in Kushiro; Nakano of Sapporo. **Hondo**: Mt. Hakkoda in Mutsu; Ôyachi of Mt. Hachimantai in Rikuchû; Mt. Komagatake, Megata, Hirumo-numa in Ugo; Ôishita in Uzen; Izu-numa in Rikuzen; jiuemon-ike in Kôzuke; Kurosawano-ike, Kôyano-ike of Mt. Myoko in Echigo; Mt. Eboshi in Etchû; Midoriga-ike of Mt. Yatsugatake in Shinano; Biwa-ike in Owari; Matsubara-naiko in Oomi. (Pl. XLVI, fig. 3)

Distr. Japan, Europe, Greenland, N.America, Azores.

**Staurostrum anatinum** COOKE & WILLS var. **pelagicum** W. & G. S. WEST in WEST & CARTER Monogr. Brit. Desm. 5, 146, 1923.

Semicellulae raro cyathiformes, longiores quam latae sine processibus, processibus gracillioribus et decoris. Long. sine proc. 43  $\mu$ , cum proc. 49.5  $\mu$ , Lat. cum proc. 73  $\mu$ , Lat. isth. 13  $\mu$ .

Hab. **Hondo**: Kesho-numa in Rikuzen. (New to Asia) (Pl. XLVII, fig. 5)

Distr. British Isles.

**Staurostrum Manfeldtii** DELP. in WEST Trans. Roy. Irish Acad. 32, 56, 1902; WEST & CARTER Monogr. Brit. Desm. 5, 114, 1923.

Cellulae mediocres, circiter 1½ latiores quam longiores cum processibus, modice constrictae, sinu aperto et acutangulo ad apicem; semicellulae aliquantulum cyathiformes vel subcuneatae, lateribus inflatis, angulis basalibus rotundatis, apicibus leviter convexis et duabus verrucis emarginatis praeditis, angulis apicalibus productis in processus longos denticulatos attenuatos horizontaliter vel leviter sursum directos et cum apicibus trispinatis, et aliquando seriebus paucorum denticulorum prope basim processuum praedi-

tis; a vertice visae trigonae, lateribus paene rectis, aliquando leviter convexis cum serie verrucarum emarginatarum intra marginem lateralem uniuscuiusque, angulis productis in processus longos attenuatos undulatos cum apicibus trispinatis. Long. 41–45  $\mu$ , Lat. cum proc. 49.5–53  $\mu$ , Lat. isth. 9.3–10.8  $\mu$ .

Hab. **Hokkaido**: Okineppe in Nemuro; Horomui in Ishikari. **Hondo**: Hakuryu-ko in Uzen. (New to Japan) (Pl. XLVIII, fig. 1)

Distr. Siberia, central China, India, Europe, Australia.

var. **annulatum** W. & G. S. WEST in Trans. Roy. Irish Acad. 32, 56, 1902; WEST & CARTER Monogr. Brit. Desm. 5, 115, 1923.

Semicellulae ad basim distincte inflatae et seriebus duabus transversis granulorum minorum praeditae, processibus leviter attenuatis et verruca apicale plus diminuter quam in forma typica. Long. 39–50  $\mu$ , Lat. 50–64  $\mu$ , Lat. isth. 11–12.6  $\mu$ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Tokotan in Kushiro; Nikuru-numa, Shimo-yûbetsu in Kitami; Horomui in Ishikari. **Hondo**: Kawashiri in Ugo; Ôishita in Uzen; Kobuchi-numa, Kesho-numa in Rikuzen; Akaiyachi in Iwashiro; Gôno-ike in Hitachi; Goda-numa in Shimofusa; Ashinota-ike, Inago of Kitamaki-mura, Kizaki, Daizahôshi-ike in Shinano; Biwa-ike in Owari; Jôdo-ike in Ise. **Kiushiu**: Miyazaki in Hiuga. (New to Asia) (Pl. XLIX, fig. 3)

Distr. British Isles, Germany.

var. **planctonicum** LÜTKEM. in GRÖNBLAD Act. Soc. Sci. Fenn. nova ser. B, 2: 5, 42, 1942; TEILING Sv. Bot. Tidskr. 41, 221, 1947.

Cellulae minores quam in forma typica, processibus denticulatis leviter divergentibus; cellulae in vertice visae cum lateribus concavis, angulis gradatim productis in processus graciles. Long. cum proc. 38–39  $\mu$ , Lat. cum proc. 60  $\mu$ , Lat. isth. 9.5  $\mu$ .

Hab. **Hondo**: Tokyo in Musashi. (New to Asia) (Pl. XLVIII, fig. 2)

Distr. Sweden.

**Staurastrum pingue** TEILING in Bot. Notis. 66, 1942; Sv. Bot. Tidskr. 41, 221, 1947; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 59, 1953.

Cellulae modicae, circiter duplo longiores quam latiores sine processibus, modice constrictae, sinu acuto acuminato ad apicem; semicellulae quadratae vel campanulatae, lateribus inflatis ad supra sinum, apice convexo vel paene recto, angulis apicalibus in processus longos nodulatos divergentes rectos vel curvatos productis, apicibus processuum truncatis et spinis 4 brevibus ordinatis; a vertice visae 4-angulares, lateribus concavis cum verruca ad

medium intra marginem, angulis in processus longos undulatos leviter attenuatos productis, apicibus processuum spinis 4 brevibus ordinatis, in basi visae isthmo quadrato, angulis leviter rotundo, in basi processuum granulo singulo ad angulos isthmos. Long. sine proc.  $30\ \mu$ , cum proc.  $60\ \mu$ , Lat. sine proc.  $15\ \mu$ , cum proc.  $60\ \mu$ , Lat. isth.  $8.6\ \mu$ .

Hab. **Hondo**: Lake Biwa in Oomi. (Pl. XLVII, fig. 1, 2)

Distr. Japan, Sweden.

**Staurastrum Sonthalianum** TURNER in K. Sv. Vet. Akad. Handl. **25**, 124, 1893; STRÖM Nyt. Mag. Naturv. **59**, 6, 1921; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. **15**, 56, 1953.

Cellulae modicae, circiter duplo latiores quam longiores cum processibus, profunde constrictae, sinu acuto et acuminato ad verticem; semicellulae elliptico-fusiformes, angulis in processus longos convergentes denticulatos leviter attenuatos productis, apicibus processuum spinis tribus acutis ordinatis, marginibus dorsalibus et ventralibus verrucosis; a vertice visae triangulares, lateribus paene rectis et glabris, angulis in processus longos nodulatos productis, et apicibus acute trispinatis, apice semicellularum cum seriebus arcuatis verrucarum intra marginem. Long.  $43\ \mu$ , Lat. cum proc.  $77.4\ \mu$ , Lat. isth.  $11.6\ \mu$ .

Hab. **Hondo**: Lake Biwa in Oomi. (Pl. XLVIII, fig. 3)

Distr. Japan, India, N. Australia.

**Staurastrum tauphorum** W. & G. S. WEST var. **sumatranum** KRIEGER in Arch. Hydrobiol. suppl. **11**, 208, 1932; HIRANO Act. Phytotax. Geobot. **14**, 51, 1950.

Var. processibus directis oblique versis, non parallelis ut in forma typica. Long.  $64\ \mu$ , Lat. cum proc.  $81-82\ \mu$ , Lat. isth.  $8.6\ \mu$ .

Hab. **Hondo**: Fuse-ike in Oomi. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XLVIII, fig. 4, 5)

Distr. Japan, Sumatra.

**Staurastrum Koidzumii** HIRANO in Act. Phytotax. Geobot. **14**, 2, 1949.

Cellulae submediocres, circiter tam longae quam latae cum processibus, modice constrictae, sinu late aperto; semicellulae cuneatae, marginibus lateralibus paullo convexis, angulis apicalibus in processus modice longos attenuatos leviter divergentes et nodulosos in apice truncatos spinis 4 ordinatos productis, processibus cum serie generaliter 2 concentricis denticulorum, apicibus semicellularum paene rectis aliquando paullo emarginatis, basis semicellularum processibus tribus prominentibus in apice valide bifurcados instructis; a vertice visae trigonae, lateribus leviter concavis, serie denticu-

lorum intra marginem unumquemque instructis, denticulis binatis ad medium sed singulis prope angulos, angulis in processus modice longos nodulosos paullo attenuatos in apice spinis acutis 4 instructos productis; in basi visae cum processibus prominentibus furcatis intra basim processuum. Long. et Lat. cum proc.  $43\ \mu$ , Lat. isth.  $11\ \mu$ .

Hab. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XLIX, fig. 9-11)

Distr. Japan.

**Staurastrum cerastes** LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 69, 1871; WOLLE Desm. U.S. 133, 1884; WEST Trans. Linn. Soc. Bot. 5, 268, 1896; SCHULZ Bot. Arch. 2, 139, 1922; WEST & CARTER Monogr. Brit. Desm. 5, 141, 1923; SMITH Wisc. Bull. 57, 110, 1924; TAYLOR Pap. Mich. Acad. Sci. 20, 188, 1935; PRESCOTT & SCOTT Trans. Amer. Micr. Soc. 61, 20, 1942.

Cellulae mediocres, paullo latiores quam longiores cum processibus, paullo constrictae, sinu aperto et acuminato ad apicem, semicellulae campanulatae in parte inferiore alte dilatatis, apicibus convexis et verrucosis, angulis apicalibus productis in processus longos validos incurvatos attenuatos, apicibus processuum truncatis et minute trispinatis, marginibus superioribus processuum verrucosis, verrucis incrinatis in denticulos prope apicem, apicibus semicellularum et marginibus superioribus processuum cum 9 verrucis, marginibus inferioribus processuum glabris; semicellulae cum aliis seriebus verrucarum ab extremitate processus ad aliam extremitatem adjacentem infra apicem semicellularum et marginem superiorem processuum praeditae; a vertice visae trigonae, lateribus concavis et verrucosis cum aliis seriebus verrucarum ab angulo ad angulum intra marginem lateralem, angulis in processibus brevibus capitatis productis. Long.  $39-42\ \mu$ , Lat.  $42-51\ \mu$ , Lat. isth.  $8.4-9.8\ \mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi; Shizukari in Oshima. **Hondo**: Fuse-ike in Oomi. (New to Asia) (Pl. L, fig. 1)

Distr. British Isles, Finland, Scandinavia, U.S.A.

**Staurastrum triforcipatum** W. & G.S. WEST in Trans. Linn. Soc. Bot. 6, 184, 1902.

Cellulae parvae, circiter  $1\frac{1}{2}$  plus latiores quam longiores cum processibus, levissime constrictae, sinu aperto excavato; semicellulae late cuneatae, apicibus truncatis leviter concavis, angulis apicalibus in processus longos incurvatos undulatos productis, apicibus processuum truncatis obtusis, marginibus superioribus processuum distincte undulatis sed inferioribus indistincte vel paene glabris; a vertice visae triangulares, lateribus concavis, angulis in processus longos incurvatos productis (processibus paene ut in *St cyrtocero*); cellulae tortae ad isthmum. Long.  $18-19.6\ \mu$ , Lat. cum proc.  $25-31\ \mu$ , Lat.

isth. 5.6–6.3  $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Tomakomai, Yûfutsu in Iburi.  
**Hondo**: Chûkawa-ike in Uzen; Akai in Iwashiro. (New to Japan) (Pl. XLVI, fig. 13)

Distr. Ceylon.

**Staurastrum acanthastrum** W. & G.S. WEST in Trans. Linn. Soc. Bot. 6, 183, 1902; CROW Journ. Bot. 61, 170, 1923; HIRANO Act. Phytotax. Geobot. 14, 51, 1950.

Cellulae mediocres, circiter  $2\frac{1}{2}$  latiores quam longiores cum processibus, modice constrictae, sinu aperto et acuto; semicellulae parve circulares, marginibus lateralibus convexis, apice convexo cum papillis, angulis apicalibus productis in processus longos denticulatos attenuatos horizontaliter directos cum apicibus acute trispinatis; a vertice visae 5-gonae, processibus longis in margine 5 denticulatis et apicibus cum tribus spinis acutis longis ornatis, cum papilla prominente intra basis processuum, in centro glabra. Long. sine proc. 26–31  $\mu$ , cum proc. 50–51  $\mu$ , Lat. sine proc. 19.6  $\mu$ , cum proc. 56–92  $\mu$ , Lat. isth. 8–9.8  $\mu$ .

Hab. **Hondo**: Fuse-ike in Oomi. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XLVIII, fig. 6, 11)

Distr. Japan, Ceylon.

**Staurastrum limneticum** SCHMIDLE var. **Burmense** W. & G.S. WEST in Ann. Roy. Bot. Gard. Calcutta 6, 222, 1907; SMITH Trans. Wisc. Acad. Sci. 20, 359, 1922; HIRANO Act. Phytotax. Geobot. 14, 103, 1952.

Var. processibus plus valide curvatis, marginibus processuum denticulatis non glabris quam in forma typica; semicellulae late cuneatae; processibus in vertice visis granulis parvis duobus intra basim processus. Long. sine proc. 32  $\mu$ , cum proc. 77  $\mu$ , Lat. cum proc. 90  $\mu$ , Lat. isth. 9.4  $\mu$ .

Hab. **Hondo**: Lake Biwa in Oomi. **Kiushiu**: Lakes Ikeda and Unagi in Satsuma. (Pl. XLIX, fig. 6–8)

Distr. Japan, Burma, U.S.A.

**Staurastrum tenuissimum** W. & G.S. WEST in Trans. Linn. Soc. Bot. 5, 78, 1895; MIGULA Krypt. Fl. II, 550, 1907.

Cellulae parvae, circiter longiores quam latiores vel leviter latiores cum processibus, profunde constrictae, sinu aperto or acuminato ad verticem; semicellulae obverse semicirculares, angulis apicalibus productis in processus longos tenues divergentes et leviter curvatos undulato-denticulatos cum apicibus 2–3 spinis minutis, apicibus semicellularum leviter concavis; a vertice visae trigonae, lateribus paene rectis, angulis productis in processus longos tenues



curvatos (ut in *St. cyrtocero*). Long.  $21.5\mu$ , Lat. cum proc.  $30\mu$ , Lat. isth.  $6.5\mu$ .

Hab. **Hondo**: Kotsutsumi-nishi-ike in Mikawa. (New to Asia) (Pl. XLIX, fig. 15, 16)

Distr. Germany, Madagascar.

**Staurastrum biwaensis** HIRANO in YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 56, 1953.

Cellulae modicae, leviter longiores quam latiores sine processibus, profunde constrictae, sinu acuto acuminato ad verticem; semicellulae triangulari-cyathi-formes, apice paene recto vel leviter concavo aliquando undulato, marginibus lateralibus leviter inflatis, angulis apicalibus in processus longos attenuatos divergente directos et nodulosos productis, apicibus processuum truncatis et acute trispinatis, ad basi superiori processuum cum protuberantibus prominentibus aliquando processibus brevibus nodulosos ordinatis; cellulae in vertice visae triangulares, lateribus leviter concavis, angulis in processus longos attenuatos nodulosos et (ut in *S. cyrtocero*) curvatos productis, apicibus processuum truncatis trispinatis, processibus cum mucro intra basi processuum ordinatis. Long. sine proc.  $26-30\mu$ , cum proc. sine spin.  $43\mu$ , Lat. sine proc.  $23-24\mu$ , Lat. cum proc.  $69-77\mu$ , Lat. isth.  $9.5-10.8\mu$ .

Hab. **Hondo**: Lake Biwa in Oomi. (Pl. XLIX, fig. 12-14)

Distr. Japan.

**Staurastrum aculeatum** (EHRENB.) MENEGH. in ROY & BISSET Journ. Bot. 24, 239, 1886; WEST & CARTER Monogr. Brit. Desm. 5, 160, 1923; ALLORGE Rev. Alg. 5, 363, 1930; OKADA Journ. Imp. Fish. Inst. 30, 179, 1934; OKADA ASAHINA's Inkwa. 187, 1940.

Cellulae modicae, circiter tam longae quam latae vel leviter latiores, profunde constrictae, sinu acuto et aperto; semicellulae subellipticae vel fusi-formes, marginibus dorsalibus et ventralibus aequaliter convexis, sed in parte ventrali convexioribus quam in parte dorsali, angulis lateralibus productis in processus breves cum apicibus tribus spinarum, cum seriebus tribus denticulorum et in basim cum tribus spinis productis; apicibus semicellularum cum serie apicali spinarum in parte mediana aliquando spinis emarginatis, et cum serie laterali spinarum ab angulo ad angulum extensis; a vertice visae trigonae, lateribus leviter concavis vel paene rectis, cum una serie spinarum (quae in medio bifurcatur) et cum altera serie apicali intra marginem quae videtur in parte mediana emarginata, angulis productis in processus breves in margine 2-3 denticulatos et in apicibus trispinatos; centro semicellularum glabro. Long.  $32-47\mu$ , cum proc.  $56\mu$ , Lat. sine proc.  $44-45\mu$ , cum proc.  $52-56\mu$ , Lat. isth.  $8.7-14\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Yûfutsu in Iburi. **Kiushiu**: Naka-

hama of Lake Ikeda in Satsuma. (Pl. L, fig. 2)

Distr. Japan, Siberia, Burma, whole Europe, N.America, Greenland, Nova Zembla, Australia, New Zealand, Patagonia, Antarctic.

var. **japonicum** HIRANO in Act. Phytotax. Geobot. **14**, 38, 1950.

Cellulae in vertice visae cum processibus duabus prominentibus ad medium laterum unumquemque. Long.  $41\ \mu$ , Lat. cum proc.  $47.3\ \mu$ , Lat. isth.  $13\ \mu$ .

Hab. **Hondo**: Tanuki-numa in Suruga. (Pl. L, fig. 3)

Distr. Japan.

var. **ornatum** NORDST. in KRIEGER Ber. Dtsch. Bot. Ges. **56**, 64, 1938.

Cellulae leviter longae quam latae, late aperto ad verticem, angulis laterilibus in processus breves productis et spinis minutis ordinatis; in vertice visae lateribus concavis, duobus verrucis prominentiis in medio ambitu marginem et aliis duobus verrucis leviter maioribus in medio intra marginem unumquemque ordinatis, angulis leviter productis in processus minute spinatos, processibus cum seriebus concentricis denticulorum. Long.  $38-39\ \mu$ , Lat.  $30\ \mu$ , Lat. isth.  $10.7\ \mu$ .

Hab. **Hondo**: Mt. Mitsumata-rengé in Etchû. (New to Asia) (Pl. L, fig. 9)

Distr. Germany, Spitzbergen.

**Staurostrum vestitum** RALFS in Brit. Desm. 143, 1848; WOLLE Desm. U.S. 138, 1884; ROY & BISSET Journ. Bot. **24**, 239, 1886; WEST & CARTER Monogr. Brit. Desm. **5**, 158, 1923; DICK Bot. Arch. **3**, 228, 1923; SMITH Wisc. Bull. **57**, 92, 1924; ALLORGE Rev. Alg. **5**, 367, 1930; OKADA Journ. Imp. Fish. Inst. **30**, 191, 1934; TAYLOR Pap. Mich. Acad. Sci. **20**, 199, 1935; WHELDEN Nat. Mus. Canad. Bull. **97**, 113, 1947.

Cellulae parvae, circiter duplo latiores quam longiores cum processibus, profunde constrictae, sinu aperto acutangulo; semicellulae subfusiformes vel subtriangulares, marginibus ventralibus leviter convexis, marginibus dorsalibus convexis cum granulis emarginatis circa 6 et granulis duobus prominentibus infra apicem, angulis apicalibus productis in processus mediocriter longos attenuatos horizontaliter vel leviter convergente directos et in margine denticulatos, processibus cum seriebus concentricis denticulorum, apicibus processuum spinis acutis tribus ornatorum; a vertice visae trigonae, lateribus concavis, cum duobus spinis bifurcatis vel cum processibus ex centro utriusque lateris projectis, et intra margines; seriebus duobus dorsalibus verrucarum emarginatarum, angulis productis in processus denticulatos; apicibus semicellularum glabris. Long.  $24-25\ \mu$ , Lat. cum proc.  $39-47.6\ \mu$ , Lat. isth.  $7.7-10\ \mu$ .

Hab. **Hokkaido**: Kiritappu, Akan-junsai-numa in Kushiro; Toyokorokonuma in Tokachi; Notoro-ponto in Kitami; Minenobu, Hisago-numa in Ishikari; Yûfutsu, Tôasa-numa, Tomakomai in Iburi; Ko-numa in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Ogata in Ugo; Ôishita in Uzen; Naganuma in Rikuzen; Bagyu-numa in Iwaki; Akai-yachi in Iwashiro; Ozegahara in Kôzuke; Kizaki, Kanori-ike, Okemi-ike in Shinano; Kotsutsuminishi-ike in Mikawa; Fuse-ike in Oomi. (Pl. L, fig. 4)

Distr. Japan, Kuriles, whole Europe, N.America, Brazil, Africa, Azores, Australia.

var. **splendidum** GRÖNBL. in Act. Soc. Faun. Flor. Fenn. 47, 81, 1920; DICK Mitt. Pfälz Ver. Nat. Pollichia 3, 141, 1930.

Cellulae in vertice visae trigonae, lateribus concavis cum processibus bifurcatis quaternis in medio (medianis duplo maioribus quam in forma typica) et intra margines laterales seriebus verrucarum emarginatarum, sed in processibus fiunt granuli vel denticuli. Long.  $21\ \mu$ , Lat. cum proc.  $38\ \mu$ , Lat. isth.  $9\ \mu$ .

Hab. **Hondo**: Mizoroga-ike in Yamashiro. (New to Asia) (Pl. L, fig. 5)

Distr. Europe, U.S.A.

The processes of our form of *Staurastrum vestitum* are less nodulated, and commonly three nodulations of semicell are visible in vertical view. This type of form is widely distributed in our country, principally on the margin of marshes or even in *sphagnum* bogs on upland.

**Staurastrum bicoronatum** JOHNSON var. **simplicius** W. & G.S. WEST in Trans. Linn. Soc. Bot. 5, 264, 1896; GRÖNBLAD Bot. Notis. 55, 1938.

Differt a forma typica cellulis sine processibus apicalibus, cellulis duplo latius quam longius, semicellulis cyathiformibus in medio sinu paulo constrictis; a vertice visae triangulares, lateribus concavis in medio processibus binis brevibus bifurcatis projectis. Long.  $19.6\text{--}25\ \mu$ , Lat. cum proc.  $36.4\text{--}43\ \mu$ , Lat. isth.  $5.6\text{--}6\ \mu$ .

Hab. **Hondo**: Izu-numa in Rikuzen; Akaiyachi in Iwashiro; Biwa-ike in Owari; Mizoroga-ike in Yamashiro. (New to Asia) (Pl. XLIX, fig. 4, 5)

Distr. Europe, U.S.A.

**Staurastrum submanfeldtii** W. & G. S. WEST in Trans. Linn. Soc. Bot. 6, 188, 1902; WEST Journ. Linn. Soc. Bot. 38, 128, 1907.

Cellulae parvae, circiter  $1\frac{1}{2}$  latiores quam longiores cum processibus, modice constrictae, sinu late aperto autem leviter acuminato ad apicem; semicellulae subcyathiformes, apicibus convexis et cum verrucis, verrucibus saepe in

processus apicales breves ordinatis, angulis apicalibus productis in processus longos horizontaliter directos attenuatos denticulatos cum apicibus spinis brevibus 3-4; verrucibus saepe emarginatis ad basim inferiorem, parte basali semicellulae cum granulis duobus, non dispositis in seriebus transversis; a vertice visae triangulares, lateribus concavis cum seriebus denticulorum emarginatis intra utrumque marginem (uno denticulo in spinam acutam producto), angulis productis in processus longos leviter denticulatos cum 3-4 spinis brevibus. Long. 51-52  $\mu$ , Lat. cum proc. 77  $\mu$ , Lat. isth. 14  $\mu$ .

Hab. **Hondo**: Shinohara-ike in Oomi. (New to Japan) (Pl. L, fig. 10)

Distr. Ceylon, central Africa.

**Staurostrum subsaltans** W. & G.S. WEST in Trans. Linn. Soc. Bot. 6, 187, 1902; HIRANO Act. Phytotax. Geobot. 14, 51, 1950.

Cellulae raro parvae, circiter  $1\frac{1}{2}$  latiores quam longiores cum processibus, modice constrictae, sinu late aperto; semicellulae obverse cuneatae, marginibus lateralibus verrucis duabus emarginatis truncatis praeditis, angulis superioribus productis in processus longos attenuatos margine 8 denticulato-nodulosos horizontaliter directos cum apicibus truncatis spinis binis verticaliter dispositis, in basi processibus spinarum binatarum praeditis, apicibus semicellularum elevatis et verrucis emarginatis duabus praeditis; verruca cum spinis binis inaequaliter longis (exteriorum longioribus); a vertice visae anguste ellipticae, intra marginem lateralem uniuscuiusque duae verrucae apicales prope medium, polis productis in processus longos. Long. 36.4-44.8  $\mu$ , Lat. cum proc. 45-56  $\mu$ , Lat. isth. 6-8  $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Tomakomai in Iburi. **Hondo**: Hijiori-naga-numa in Uzen; Akaiyachi in Iwashiro; Fuse-ike in Oomi. (Pl. L, fig. 8)

Distr. Japan, Ceylon.

**Staurostrum controversum** BRÉB. in RALFS Brit. Desm. 141, 1848; WOLLE Desm. U.S. 143, 1884; WEST Journ. Roy. Micr. Soc. 6, 295, 1890; SCHULZ Bot. Arch. 2, 139, 1922; WEST & CARTER Monogr. Brit. Desm. 5, 162, 1923; HIRANO Act. Phytotax. Geobot. 14, 170, 1952.

Cellulae submediocres, circiter  $1\frac{1}{2}$ -2 duplo latiores quam longiores cum processibus, modice constrictae, sinu aperto acutangulo; semicellulae subfusiformes vel subellipticae, marginibus lateralibus inferioribus ventricosis, marginibus lateralibus superioribus valide convexis, angulis apicalibus in processus longos robustos inflexos productis, apicibus processuum cum binis spinis minutis per processus totum granulis in seriebus concentricis dispositis, apicibus semicellularum in serie spinis vel bifid-spinis minutis dispositis; a

vertice visae 4-gonae, lateribus concavis cum duobus processibus brevibus emarginatis intra marginem prope medium uniuscuiusque, angulis in processus robustos curvatos (ut in st. cyrtocero) productis, verruca emarginata ad basim processus uniuscuiusque utrobique et cum denticulis ad marginem apicis. Long. 22-24  $\mu$ , Lat. cum proc. 39-54  $\mu$ , Lat. isth. 8-10  $\mu$ .

Hab. **Hokkaido**: Kamikoshi-ukishimahara in Ishikari. **Hondo**: Megata in Ugo; Kobuchi-numa in Rikuzen; Mt. Gassan in Uzen; Nogiwano-kwannon-ike in Iwashiro; Nushiri-daira of Oze in Kôzuke; Tsuga-daira in Shinano. (Pl. L, fig. 11)

Distr. Japan, Europe, N.America.

The number of small apical processes does not coincide with the description and figure given by W. & G. S. WEST. In our form from Oze-district a pair of small emarginate verrucae or apical processes is disposed at the middle within each margin in vertical view of semicell while in British form three or four are visible within each side and also marginal processes are few in number; however the curved processes in vertical view and the convergent manner of processes is quite characteristic of this species.

**Staurastrum saltans** JOSHUA in Journ. Linn. Soc. Bot. 21, 641, 1886; TURNER K. Sv. Vet. Akad. Handl. 25, 122, 1893; WEST Trans. Linn. Soc. Bot. 6, 188, 1902; HIRANO Act. Phytotax. Geobot. 14, 51, 1950.

Cellulae submediocres, circiter  $2\frac{1}{2}$  latiores quam longiores cum processibus, modice constrictae, sinu late aperto leviter acuminato ad apicem; semicellulae late cuneatae et sursum dilatatae, apicibus semicellularum subrectis cum parte mediana elevata et recta vel convexa, angulis lateralibus elevatis et cum duabus spinis inflatis ornatis, angulis apicalibus productis in processus longos attenuatos denticulatos leviter incurvatos cum apicibus truncatis et bispinatis, spinis verticaliter ornatis et inaequalibus in parte superiori longioribus; a vertice visae ellipticae, polis productis in processus longos cum spina terminali intra polos. Long. 31-32  $\mu$ , Lat. cum proc. 59-77  $\mu$ , Lat. isth. 8.4-8.7  $\mu$ .

Hab. **Hokkaido**: Yûfutsu in Iburi; Shizukari in Oshima. **Hondo**: Nogiwano-kwannon-ike in Iwashiro; Ishigaki-ike in Ise; Shinohara-ike in Oomi. (Pl. L, fig. 7)

Distr. Japan, Burma, India, Ceylon.

**Staurastrum leptocladum** NORDST. in WOLLE Desm. U.S. 136, 1884; WEST Journ. Linn. Soc. Bot. 33, 317, 1898; SMITH Wisc. Bull. 57, 102, 1924; OKADA Bot. Mag. 50, 256, 1936; PRESCOTT Pap. Mich. Acad. Sci. 25, 92, 1940; PRESCOTT & SCOTT Trans. Amer. Micr.

Soc. **61**, 22, 1942; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. **15**, 59, 1953. — var. *cornutum* WILLE in ROY & BISSET Journ. Bot. **24**, 239, 1886.

Cellulae modicae, subduplo longiores quam latiores, leviter constrictae, sinu late aperto; semicellulae subcampanulatae cum parte basali inflatae, angulis apicalibus productis in processus valde longos gracillimos attenuatos denticulatos, horizontaliter autem leviter recurvatos cum apicibus distincte spinatis, apicibus semicellularum leviter convexis spinis duabus longis infra marginem praeditis, in parte basali-inflato semicellularum seriebus horizontalibus elongatis granulorum praeditis; a vertice visae biradiatae, fusiformes, polis productis in processus longos leviter attenuatos cum apicibus brevibus spinis ornatis. Long. 36–39  $\mu$ , Lat. 98–107  $\mu$ , Lat. isth. 8–8.7  $\mu$ .

Hab. **Hokkaido**: Tomakomai, Yûfutsu in Iburi; Shizukari, Konuma in Oshima. **Hondo**: Kitaura in Hitachi; Shinohara-ike, Lake Biwa in Oomi; Mizoroga-ike, Takaraga-ike in Yamashiro; Ikejiri-ike in Tanba. **Kiushiu**: Nakahara-ike near Fukiagenohama in Satsuma; Miyazaki in Hiuga. (Pl. L, fig. 6)

Distr. Japan, Burma, central Africa, U.S.A.

#### Sect. **Radiatiformes** HIRANO, sect. nov.

Cellulae cum processibus apicalibus et dorsalibus, processibus glabris in toto margine longitudinis sed apicibus spinatis.

- 1a. Cellulae sine serie ventralibus processuum.
  - 2a. Processibus longis..... **St. tohopekaligense**
  - 2b. Processibus relative brevibus.
    - 3a. Cellulae in vertice visae cum processibus duobus dorsalibus, processibus e margine lateris corporis projectis.
      - 4a. Processibus trifurcatis.....var. **trifurcatum**
      - 4b. Processibus bifurcatis..... **St. subarmigerum**
    - 3b. Cellulae in vertice visae cum processibus singulis dorsalibus..... **St. Clevei**
- 1b. Cellulae cum serie dorsalium et ventralium processuum.
  - 2a. Cellulae 28  $\mu$  in longitudinem sine processibus.....**St. Hantzii** var. **japonicum**
  - 2b. Cellulae 56  $\mu$  in longitudinem sine processibus.....**St. leptacanthum**

**Staurostrum tohopekaligense** WOLLE in Freshw. Alg. U.S. 45, 1887; WEST Trans. Linn. Soc. Bot. **6**, 180, 1902; Journ. Linn. Soc. Bot. **38**, 130, 1907; WEST & CARTER Monogr. Brit. Desm. **5**, 178, 1923; DICK Bot. Arch. **3**, 228, 1923; SMITH Wisc. Bull. **57**, 120, 1924; OKADA ASAHINA's Inkwa. 179, 1939; PRESCOTT Pap. Mich. Acad. Sci. **25**, 95, 1940.

Cellulae magnae, circiter 1½ longiores quam latiores sine processibus, profunde constrictae, sinu aperto et acutangulo ad verticem leviter acuminato; semicellulae late ellipticae, angulis lateralibus productis in processus longos gracillimos glabros cum apicibus profunde bifurcatis; seriebus processuum

dorsalium similibus in partes tres oblique sursum projectis; a vertice visae generaliter triangulares, lateribus leviter convexis vel rectis, angulis productis in processus longos gracillimos glabros, lateribus cum processibus dorsalibus duobus ad lateralem partem prominentibus. Long. sine proc.  $36.5\ \mu$ , cum proc.  $47.3\ \mu$ , Lat. sine proc.  $25\ \mu$ , cum proc.  $64.5\ \mu$ , Lat. isth.  $14\ \mu$ .

Hab. **Hondo**: Kotsutsumi-nishi-ike, Suhara-ike in Mikawa; Fuse-ike in Oomi. (Pl. LI, fig. 1, 2)

Distr. Japan, India, Ceylon, Germany, Finland, Letland, U.S.A., central Africa.

var. **trifurcatum** W. & G.S. WEST in Trans. Linn. Soc. Bot. 5, 80, 1895; l.c. 6, 181, 1902; SCHULZ Bot. Arch. 2, 144, 1922; WEST & CARTER Monogr. Brit. Desm. 5, 179, 1923.

Var. processibus brevioribus, apicibus processuum trifurcatis. Long. sine proc.  $33.6\ \mu$ , cum proc.  $50.4\ \mu$ , Lat. sine proc.  $26\ \mu$ , cum proc.  $47.6\ \mu$ , Lat. isth.  $12.6\ \mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. (Pl. LI, fig. 3)

Distr. Japan, Ceylon, India, Germany, British Isles, Estonia, Australia, Madagascar.

**Staurastrum subarmigerum** ROY. & BISSET in Journ. Bot. 24, 239, 1886; TURNER K. Sv. Vet. Akad. Handl. 25, 120, 1893.

Cellulae submediocres, leviter longiores quam latiores sine processibus, modice constrictae, sinu late aperto sed acuminato ad apicem; semicellulae subellipticae, marginibus inferioribus ventricosis, apice paene recto aliquando leviter convexo, angulis productis in processus longos glabros in apice profunde bifidos et in plano verticali ornatos, cum aliis processibus similibus prope apicem semicellularum; a vertice visae triangulares, lateribus concavis processibus duobus longis intra marginem lateris uniuscuiusque, angulis gradatim in processus productis. Long. sine proc.  $25.8\ \mu$ , cum proc.  $43\ \mu$ , Lat. sine proc.  $21.5\ \mu$ , cum proc.  $43\ \mu$ , Lat. isth.  $11.6\ \mu$ .

Hab. **Hokkaido**: Tôasa-numa, Yûfutsu in Iburi. (Pl. LI, fig. 5)

Distr. Japan, India.

**Staurastrum Clevei** (WITTR.) ROY & BISSET in WEST & CARTER Monogr. Brit. Desm. 5, 177, 1923; TAYLOR Pap. Mich. Acad. Sci. 20, 188, 1935.

Cellulae submediocres, paullo longiores quam latiores sine processibus, profunde constrictae, sinu acute aperto et acuminato ad verticem; semicellulae subellipticae, marginibus inferioribus valde ventricosis, marginibus superioribus paullo convexis, angulis lateralibus gradatim in processus longos

glabros productis, apicibus processuum profunde bifidis et dilatatis in plano verticali, corpore semicellularum cum alia serie processuum similiter in oblique ad basim processuum angulorum projecto; a vertice visae triangulares, lateribus paene rectis, angulis in processus productis, processibus dorsalibus in oblique projectis prope angulos trans latus unumquodque; membrana glabra. Long. sine proc. 25-26  $\mu$ , cum proc. 49.5  $\mu$ , Lat. sine proc. 30  $\mu$ , cum proc. 43  $\mu$ , Lat. isth. 12  $\mu$ .

Hab. **Hokkaido**: Sanno-numa on Mt. Daisetsu in Ishikari. (New to Asia) (Pl. LI, fig. 4)

Distr. Europe, N. America.

**Staurostrum Hantzii** REINSCH var. **japonicum** ROY & BISSET in Journ. Bot. 24, 240, 1886; HIRANO Act. Phytotax. Geobot. 12, 162, 1943.

Cellulae mediocres; semicellulae late ellipticae vel subcirculares, processibus longis et tenuibus. Long. sine proc. 22.4-28  $\mu$ , cum proc. 38-57.6  $\mu$ , Lat. sine proc. 19.6-22.4  $\mu$ , cum proc. 38-62  $\mu$ , Lat. isth. 11-14  $\mu$ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Akan-junsai-numa in Kushiro; Shimoyûbetsu in Kitami; Toyokoro in Tokachi; Nakano near Sapporo, Horomui in Ishikari; Shizukari in Oshima. **Hondo**: Koke-numa in Ugo; Ôishita in Uzen; Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Bagyu-numa in Iwaki; Mt. Kirigamine, Kizaki in Shinano; Ishigaki-ike, Jôdo-ike in Ise; Nukigawa, Lake Biwa, Fuse-ike, Mt. Hira in Oomi; Mizoroga-ike in Yamashiro. **Kiushiu**: Koshiki-ike of Mt. Kirishima in Hiuga. (Pl. LI, fig. 10, 11)

Distr. Japan, China, India.

**Staurostrum leptacanthum** NORDST. in WEST Journ. Linn. Soc. Bot. 33, 319, 1898; Trans. Linn. Soc. Bot. 6, 180, 1902; KRIEGER Arch. Hydrobiol. suppl. 11, 201, 1932.

Cellulae parvae, leviter longiores quam latiores sine processibus, modice constrictae, sinu acuminato ad apicem; semicellulae subellipticae, marginibus lateralibus inferioribus convexioribus quam lateralibus superioribus, angulis in processus longos glabros apice 2-3 furcatis productis, cum 6 processibus similibus in seriebus dorsalibus et ventralibus oblique alte projectis; a vertice visae triangulares, angulis in processus longos attenuatos glabros productis, lateribus paene rectis vel leviter convexis vel concavis, uterque cum processibus duobus et processibus similibus duobus intra utrumque marginem; ad apicem omnibus processibus 2-3 furcatis. Long. sine proc. 36.4-45  $\mu$ , cum proc. 56-67  $\mu$ , Lat. sine proc. 28-39  $\mu$ , cum proc. 50-84  $\mu$ , Lat. isth. 11-16.5  $\mu$ .

Hab. **Hondo**: Chûkawa-ike, Ôishitano-junsaitsutsumi in Uzen; Inago of Kitamaki-mura, Amaga-ike on Mt. Yatsugatake in Shinano; Fuse-ike in Oomi.



(New to Japan) (Pl. LI, fig. 9)

Distr. Burma, Java, Ceylon, Sweden, Finland, U.S.A.

**Sect. Hoplastrum** TURNER emend. HIRANO

*Staurastrum* subgen. *Hoplastrum* TURNER in K. Sv. Vet. Acad. Handl. 25, 132, 1893.

Cellulae cum processibus apicalibus et dorsalibus, processibus granulo vel denticulo in toto margine longitudinis ordinatis sed apicibus spinatis.

- 1a. Cellulae cum serie dorsali brevium processuum.
  - 2a. Cellulae  $56\mu$  in longitudinem sine processibus, in vertice visae 3-gonae, cum processibus singulis asymmetricis ad marginem unumquemque ordinatis.....**St. javanicum**
  - 2b. Cellulae  $30-32\mu$  in longitudinem sine processibus, in vertice visae 3-5-gonae.
    - 3a. Cellulae in vertice visae trigonae, cum processibus singulis, processibus non projectis de corpore, semicellulae cuneatae.....**St. galeatum**
    - 3b. Cellulae in vertice visae 5-gonae, cum processibus duobus ad marginem, processibus projectis de corpore, semicellulae campanulatae..... **St. pinnatum** var. **subpinnatum**
  - 2c. Cellulae  $20-25\mu$  in longitudinem sine processibus.
    - 3a. Cellulae in vertice visae 3-gonae, cum processibus duobus dorsalibus ad marginem unumquemque, semicellulae triangulares .....**St. arcuatum**
    - 3b. Cellulae in vertice visae 3-5-gonae, cum processibus duobus dorsalibus et ventralibus ad marginem unumquemque, semicellulae elliptico-fusiformes.....**St. incurvum**
    - 4a. Cellulae in vertice visae 5-gonae, processibus incurvatis..... f. **typica**
    - 4b. Cellulae in vertice visae 3-gonae, processibus horizontaliter productis ..... var. **japonicum**
- 1b. Cellulae cum serie dorsali longorum processuum.
  - 2a. Cellulae cum serie dorsali sola processuum.
    - 3a. Cellulae in vertice visae generaliter 3-gonae, processibus dorsalibus de apice corporis projectis.....**St. furcigerum**
    - 4a. Cellulae cum processibus tribus dorsalibus..... f. **typica**
    - 4b. Cellulae cum processibus 6 dorsalibus.
      - 5a. Processibus dorsalibus longis et gracilibus ..... var. **armigerum** forma **gracillima**
      - 5b. Processibus dorsalibus robustis et non longis..... var. **eustephanum**
  - 3b. Cellulae in vertice visae 5-6-gonae, processibus dorsalibus de processo angulare projectis..... **St. sexangulare**
    - 4a. Processibus dorsalibus longis, oblique projectis de processo ventrali..... var. **subglabrum**
    - 4b. Processibus dorsalibus robustis, juxta supra processus ventrales projectis..... var. **crassum**
  - 2b. Cellulae cum serie dorsali et ventrali processuum, cellulae generaliter 3-gonae.....**St. arcticon**

**Staurastrum javanicum** (NORDST.) TURNER in K. Sv. Vet. Akad. Handl. 25, 129, 1893; SKUJA Symb. Sinica 1, 96, 1937.

Cellulae magnae, circiter  $1\frac{1}{2}$  latiores quam longiores cum processibus, modice constrictae, sinu aperto et paene rectangulari sed acuminato ad apicem; semicellulae aliquantulum campanulatae, in parte basali tumidae et denticulis duabus in verticaliter dispositae, denticulis duabus similibus juxta intra marginem ordinatae, angulis apicalibus in processus longos denticulatos incurvatos leviter attenuatos in apice truncato et 4 spinis acutis ordinato productis, apicibus semicellularum convexis et duabus processibus apicalibus prominentiis ad marginem utrobique et duabus verrucis emarginatis in medium marginem ordinatis, processibus apicalibus in apice 2-4 spinis brevibus ordinatis, semicellulae cum seriebus duobus denticulorum aliquando irregulariter in formam 3-4 angulari ordinatae; a vertice visae triangulares, lateribus concavis et paene glabris, angulis in processus longos leviter denticulatos vel nodulosos attenuatos in apice acute 4-spinatos et in margine serie denticulorum a basi processuum ad apicem ordinatos productis, lateribus intra marginem unumquemque cum serie apicalibus processuum in longitudinis variabilis et 5 compositis, duobus medianis brevibus et duobus exterius uterque (internis longis et prominentibus et externis reductis) irregulariter asymmetrice alterius projectis et alterius reductis. Long.  $56\mu$ , Lat. cum proc.  $75-76\mu$ , Lat. isth.  $14\mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. (New to Japan) (Pl. LI, fig. 6, 7)  
Distr. India, Java.

**Staurostrum galeatum** TURNER in K. Sv. Vet. Akad. Handl. 25, 122, 1893; WEST Trans. Linn. Soc. Bot. 6, 190, 1902.

Cellulae mediocres, circiter  $1\frac{1}{2}$  plo latiores quam longiores cum processibus, profunde constrictae, sinu late aperto et acuminato ad extremum; semicellulae aliquando campanulatae, marginibus lateralibus inferioribus tumidis, apicibus elevatis truncatisque et rectis cum spinis acutis utrobique, angulis apicalibus in processus longos horizontales vel leviter incurvatos attenuatos duriter in margine 2-3 denticulatos et in apice truncatos acute trispinatos productis, cum processibus brevibus prominentibus in apice, bispinatis versus erectis productis ad basim processuum, in margine inferiore ad basim processuum denticulatis ordinatis; a vertice visae triangulares, lateribus concavis, angulis in processus longos leviter undulatos in apice leviter dilatatos et acute trispinatos productis, cum processibus brevibus ad basim intra processus et denticulis juxta infra partem processuum apicalium ordinatis. Long.  $30-31\mu$ , Lat. cum proc.  $45\mu$ , Lat. isth.  $7\mu$ .

Hab. **Hondo**: Ônuma in Mikawa. (New to Japan) (Pl. LII, fig. 4)  
Distr. India, Ceylon.

**Staurastrum pinnatum** TURNER var. **subpinnatum** (SCHMIDLE) W. & G.S. WEST in Trans. Linn. Soc. Bot. 6, 182, 1902; BORGE Ark. Bot. 8, 10, 1909; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 47, 72, 1920; SCHULZ Bot. Arch. 2, 142, 1922.

Var. partibus basalibus semicellularum glabris et annulo granulorum ad basim supra isthmum. Long.  $31\ \mu$ , Lat. cum proc.  $43\ \mu$ , Lat. isth.  $9.4\ \mu$ .

Hab. **Hondo**: Akaiyachi in Iwashiro. (New to Japan) (Pl. LII, fig. 11)

Distr. Ceylon, Germany. Finland.

**Staurastrum arcuatum** NORDST. in ROY & BISSET Journ. Bot. 24, 238, 1886; MIGULA Krypt. Fl. II, 554, 1907; WEST & CARTER Monogr. Brit. Desm. 5, 180, 1923; HOMFELD Pflanzenf. 12, 69, 1929; PRESCOTT Univ. Iowa Stud. 13, 133, 1931.

Cellulae parvae, leviter longiores quam latiores cum processibus sine spinis, profunde constrictae, sinu acuto aperto; semicellulae obverse triangulares, marginibus lateralibus inferioribus leviter convexis, apicibus paene rectis vel leviter convexis, angulis apicalibus in processus breves attenuatos nodulosos in apice spinis duabus verticaliter ordinatos et in margine serie radiali 2-3 granulorum productis; a vertice visae trigonae, lateribus leviter concavis cum processibus dorsalibus duobus brevibus ad medium intra marginem, processibus dorsalibus in apice bispinatis, angulis in processus breves in apice bispinatos productis et serie 2-3 radiali granulorum ad angulos ordinatis. Long. cum proc.  $25\ \mu$ , Lat. cum proc.  $36.4\ \mu$ , Lat. isth.  $5.6\ \mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro. (Pl. LI, fig. 12)

Distr. Japan, Siberia, India, Europe, Greenland, U.S.A., Colombia, Azores.

**Staurastrum incurvum** (HIRANO) HIRANO, stat. nov.

*Staurastrum senarium* (EHRENB.) RALFS var. *incurvum* HIRANO in Mem. Coll. Sci. Univ. Kyoto B. 19, 67, 1948.

Cellulae parvae, circiter  $1\frac{1}{3}$ - $1\frac{1}{2}$  latiores quam longiores cum processibus, profunde constrictae, sinu acuto aperto extrorsum subelliptico; semicellulae subellipticae vel sublunatae cum processibus, angulis apicalibus in processus breves incurvatos glabros productis, extremitatibus truncatis et bispinatis, apicibus semicellularum convexis cum serie dorsali processuum, apicibus processuum dorsalium spinatis, marginibus lateralibus inferioribus semicellularum glabris et concavis; a vertice visae 4-5-gonae, angulis in processus productis et cum processibus marginibus prope extremitatem utrobique, lateribus concavis cum processibus duobus dorsalibus ad medium intra marginem, processibus dorsalibus minoribus quam processibus marginum, processibus omnibus bispinatis. Long.  $21\ \mu$ , Lat. cum proc.  $31\ \mu$ , Lat. isth.  $10\ \mu$ .

Hab. **Hondo**: Koke-numa in Ugo; Ozegahara in Kôzuke. (Pl. LII, fig. 8)  
Distr. Japan.

var. **japonicum** HIRANO, comb. nov.

*Stauroastrum senarium* (EHRENB.) RALFS var. *japonicum* HIRANO in Mem. Coll. Sci. Univ. Kyoto, B, 19, 68, 1948.

Var. semicellulae ellipticae, angulis in processus horizontaliter non incurvatos directos productis; in vertice visae trigonae, angulis leviter productis et subacutis. Long. cum proc.  $34\ \mu$ , Lat. cum proc.  $31\ \mu$ , Lat. isth.  $8.4\ \mu$ .

Hab. **Hondo**: Ôyachi on Mt. Hachimantai in Rikuchû; Ozegahara in Kôzuke. (Pl. LII, fig. 9, 10)

Distr. Japan.

**Stauroastrum furcigerum** BRÉB. in WOLLE Desm. U.S. 146, 1884; WEST Journ. Linn. Soc. Bot. 34, 396, 1899; KAISER Krypt. Forsch. 1, 228, 1919; WEST & CARTER Monogr. Brit. Desm. 5, 188, 1923; SMITH Wisc. Bull. 57, 122, 1924; TAYLOR Pap. Mich. Acad. Sci. 20, 191, 1935; PRESCOTT l.c. 25, 92, 1940.

Cellulae submagnae, leviter longiores quam latiores sine processibus, profunde constrictae, sinu aperto acutangulo; semicellulae ellipticae, marginibus lateralibus dorsalibus et ventralibus aequaliter convexis, angulis lateralibus profundis in processibus brevibus robustis, apicibus processuum bispinatis acutis, apicibus semicellularum in serie superiore processuum 3 exterius productis, marginibus processuum nodulosis et granulis in seriebus tribus concentricis praeditis; a vertice visae trigonae, lateribus leviter concavis cum processibus binis ad marginem lateralem uniuscuiusque et processibus similibus binis leviter brevioribus intra marginem, angulis gradatim attenuatis et in processus breves robustos productis, processibus cum granulis in tribus seriebus concentricis. Long. sine proc.  $42\ \mu$ , cum proc.  $72-73\ \mu$ , Lat. cum proc.  $61-62\ \mu$ , Lat. isth.  $25\ \mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Benten-numa, Tôasa-numa in Iburi. **Hondo**: Ozegahara in Kôzuke; Onjaga-ike in Kamifusa. (New to Japan) (Pl. LI, fig. 8)

Distr. Siberia, Mongolia, whole Europe, Faeroes, Iceland, Greenland, N. America, Patagonia.

var. **armigerum** (BRÉB.) NORDST. forma **gracillima** SMITH in Wisc. Bull. 57, 123, 1924.

Forma cellulis similibus in forma typica, seriebus processibus apicalibus 6, processibus longioribus quam in forma typica, processibus angulo distincte

longis. Long. cum. proc. 62-68  $\mu$ , sine proc. 30-32  $\mu$ , Lat. cum proc. 59-73  $\mu$ , sine proc. 27-30  $\mu$ , Lat. isth. 12-15  $\mu$ .

Hab. **Hokkaido**: Nikuru-numa in Kitami. **Hondo**: Ozegahara in Kôzuke. (New to Asia) (Pl. LII, fig. 2)

Distr. U.S.A.

var. **eustephanum** (EHRENB.) NORDST. in WEST & CARTER Monogr. Brit. Desm. 5, 190, 1923.

Var. seriebus processibus superioribus 6 in formam triangulari ordinatis. Long. cum proc. 48-59  $\mu$ , sine proc. 42  $\mu$ , Lat. cum proc. 45-50  $\mu$ , Lat. isth. 11-14  $\mu$ .

Hab. **Hokkaido**: Shimoyûbetsu in Kitami; Horomui in Ishikari; Tomakomai in Iburi. (New to Asia) (Pl. LII, fig. 1)

Distr. British Isles, Germany, Switzerland, U.S.A., New Zealand.

**Staurastrum sexangulare** (BULNH.) LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 71, 1871; WEST & CARTER Monogr. Brit. Desm. 5, 194, 1923.

Cellulae mediocres vel magnae, leviter longiores quam latiores sine processibus, profunde constrictae, sinu acute aperto; semicellulae ellipticae vel subfusiformes, apicibus leviter convexis, marginibus inferioribus leviter ventricosis, productis ad angulos laterales, processibus lateralibus diversis in processus inferiores et superiores, semicellulis cum aliis seriebus processuum inferiorem et superiorem horizontaliter dispositis trans semicellulam ordinatis (4-5 pars visis), seriebus inferioribus processuum paene horizontalibus vel levissime convergentibus, seriebus superioribus processuum divergentibus, processibus omnibus in apice 3-4 spinato et cum in margine cum seriebus 2-3 denticulorum; a vertice visae generaliter 5-7 radiatae, lateribus valide concavis, cum granulis duobus ad medium juxta intra marginem unumquemque, angulis in processus longos attenuatos productis, cum processibus superioribus projectis ad basim processuum inferiorem utrimque, seriebus superioribus et inferioribus processuum raro exacte acervaris, seriebus superioribus processuum levissime tortis in unum. Long. cum proc. 67  $\mu$ , Lat. cum proc. 64.5  $\mu$ , Lat. isth. 12  $\mu$ .

Hab. **Hokkaido**: Benten-numa in Iburi. (Pl. LII, fig. 5)

Distr. Japan, Siberia, central China, Burma, India, Ceylon, Java, Malay, whole Europe, Australia, New Zealand.

var. **subglabrum** W. & G.S. WEST in Trans. Linn. Soc. Bot. 6, 181, 1902; OKADA Bot. Mag. 50, 259, 1936.

Cellulae in vertice visae 5-gonae, processibus superioribus valide subflexis

in unum, annulo novem granulorum intra marginem. Long. sine proc. 28–44  $\mu$ , cum proc. 56–67  $\mu$ , Lat. cum proc. 62–73  $\mu$ , Lat. isth. 8.5–15  $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Shimoyûbetsu in Kitami; Toyokoro in Tokachi; Tomakomai, Tôasa-numa, Yûfutsu, Benten-numa in Iburi; Shizukari in Oshima. **Hondo**: Koke-numa, Hirumo-numa in Ugo; Chûkawa-ike, Ôishitano-junsaitsutsumi in Uzen; Izu-numa in Rikuzen; Nogiwano-kwanon-ike, Akai in Iwashiro; Kotsutsumi-nishi-ike, Ônuma in Mikawa; Ishigaki-ike, Jôdo-ike, Tamaru in Ise; Shinohara-ike, Fuse-ike in Oomi; Mizoroga-ike, Takaraga-ike in Yamashiro; Ikejiri-ike in Tanba. **Kiushiu**: Lakes Unagi and Kagami, Nakahama of Lake Ikeda in Satsuma. (Pl. LII, fig. 3)

Distr. Japan, Ceylon.

var. **crassum** TURNER in K. Sv. Vet. Akad. Handl. 25, 117, 1893; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 47, 77, 1920.—forma *glabrum* TURNER in OKADA Bot. Mag. 50, 432, 1936.

Var. processibus brevioribus et robustioribus sine granulis apicalibus. Long. sine proc. 56  $\mu$ , cum proc. 92  $\mu$ , Lat. sine proc. 53  $\mu$ , cum proc. 98  $\mu$ , Lat. isth. 22  $\mu$ .

Hab. **Hondo**: Ishigaki-ike in Ise; Fuse-ike in Oomi. (Pl. LII, fig. 6, 7)

Distr. Japan, India, Finland.

**Staurastrum arctiscon** (EHRENB.) LUND. in Nov. Act. Regn. Soc. Ups. ser. 3, VIII, 70, 1871; WOLLE Desm. U.S. 148, 1884; MIGULA Krypt. Fl. II, 553, 1907; WEST & CARTER Monogr. Brit. Desm. 5, 193, 1923; SMITH Wisc. Bull. 57, 124, 1924; KAISER Krypt. Forsch. 1, 439, 1926; TAYLOR Pap. Mich. Acad. Sci. 20, 186, 1935; OKADA Bot. Mag. 50, 81, 1936; PRESCOTT Pap. Mich. Acad. Sci. 25, 90, 1940; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 60, 1953.

Cellulae magnae, circiter  $1\frac{1}{2}$  longiores quam latiores cum processibus, modice constrictae, sinu aperto et subacuminato ad apicem; semicellulae ellipticae cum coronis duabus processuum, in media parte processibus ventralibus 9 horizontaliter directis projectis quorum apparent (5 visis trans semicellulam), seriebus dorsalibus 6 projectis a parte apicis semicellulae, processibus omnibus longis robustis cum 2–4 seriebus concentricis denticulorum et ad verticem apicibus spinis tribus acutis ornatis; a vertice visae paene circulares, cum serie marginali 9 processuum et serie apicali ex 6 processibus ornatis. Long. sine proc. 50–52  $\mu$ , cum proc. 86–87  $\mu$ , Lat. sine proc. 36–39  $\mu$ , cum proc. 77–86  $\mu$ , Lat. isth. 24–27  $\mu$ .

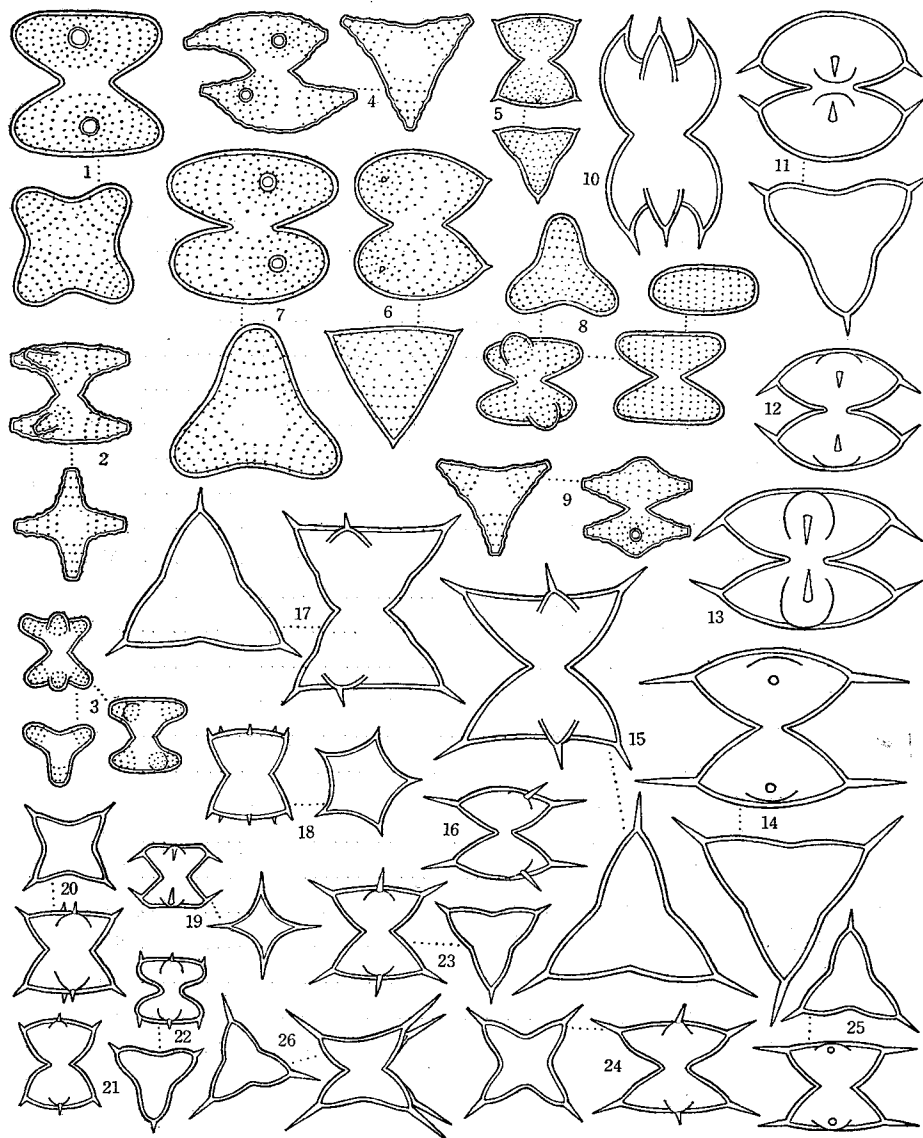
Hab. **Hokkaido**: Toyokoro in Tokachi; Yûfutsu in Iburi. **Hondo**: Jôdo-ike in Ise; Shinohara-ike, Lake Biwa in Oomi. (Pl. LIII, fig. 1)

Distr. Japan, Siberia, Europe, Alaska, U.S.A.

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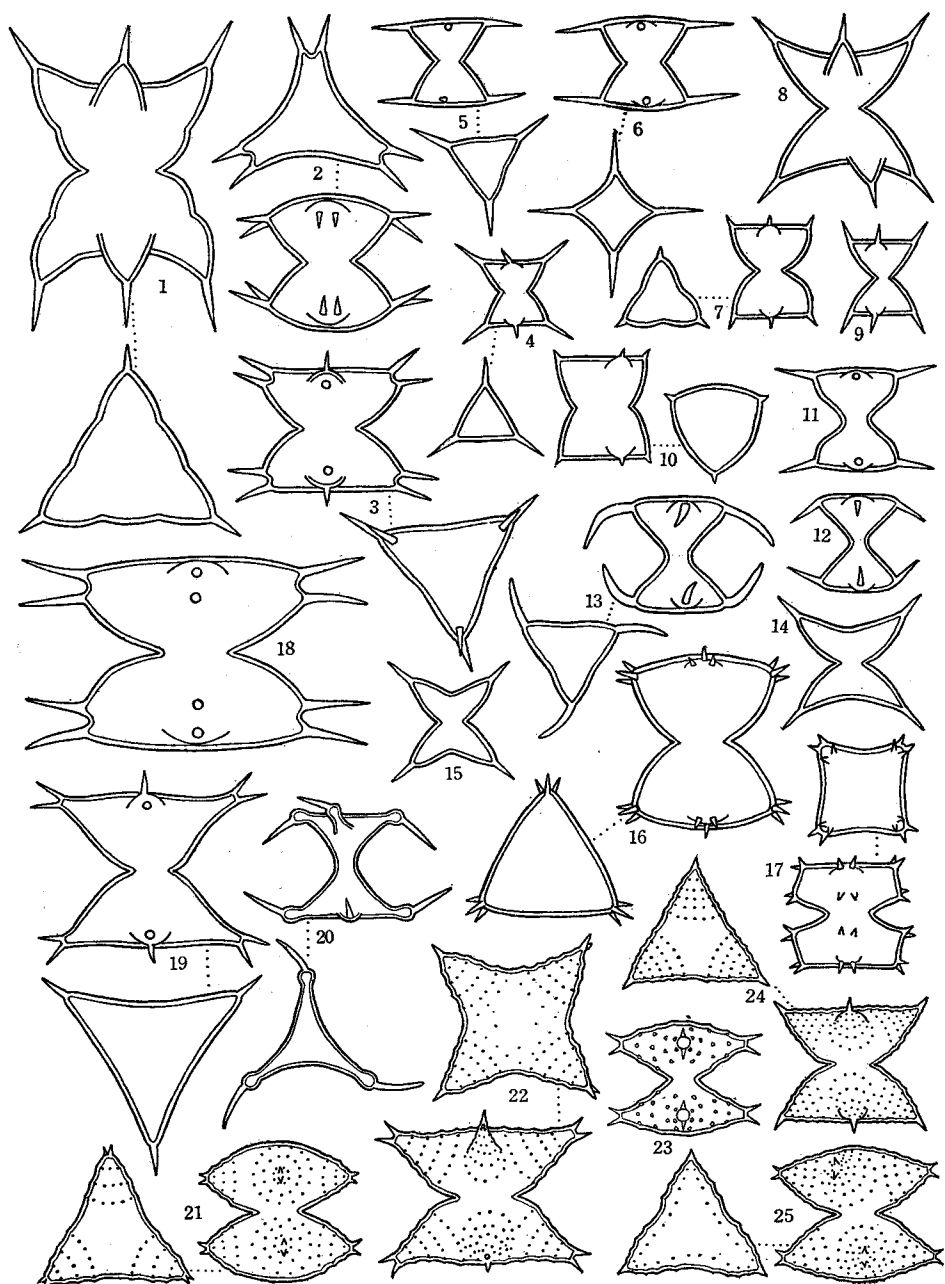




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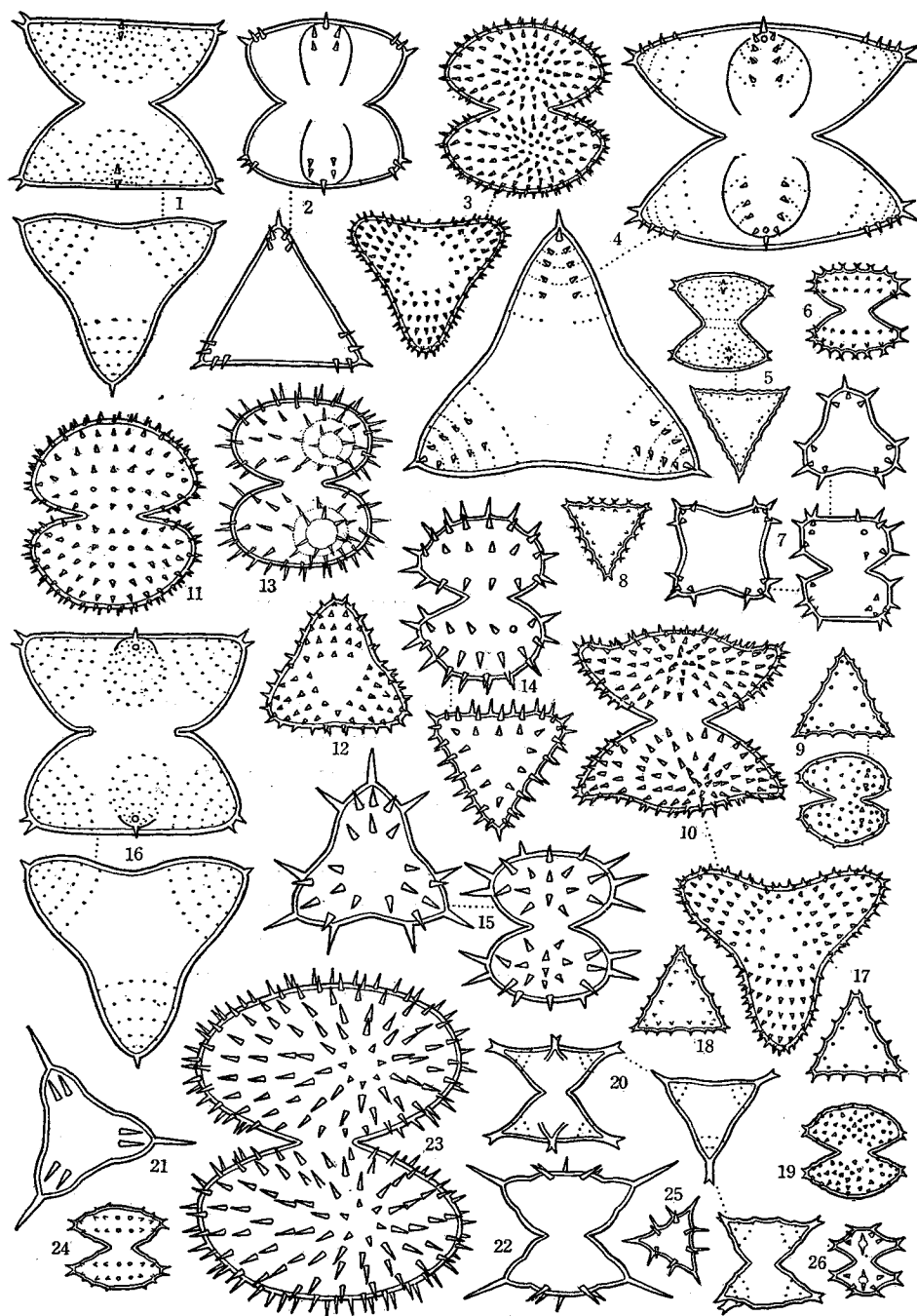
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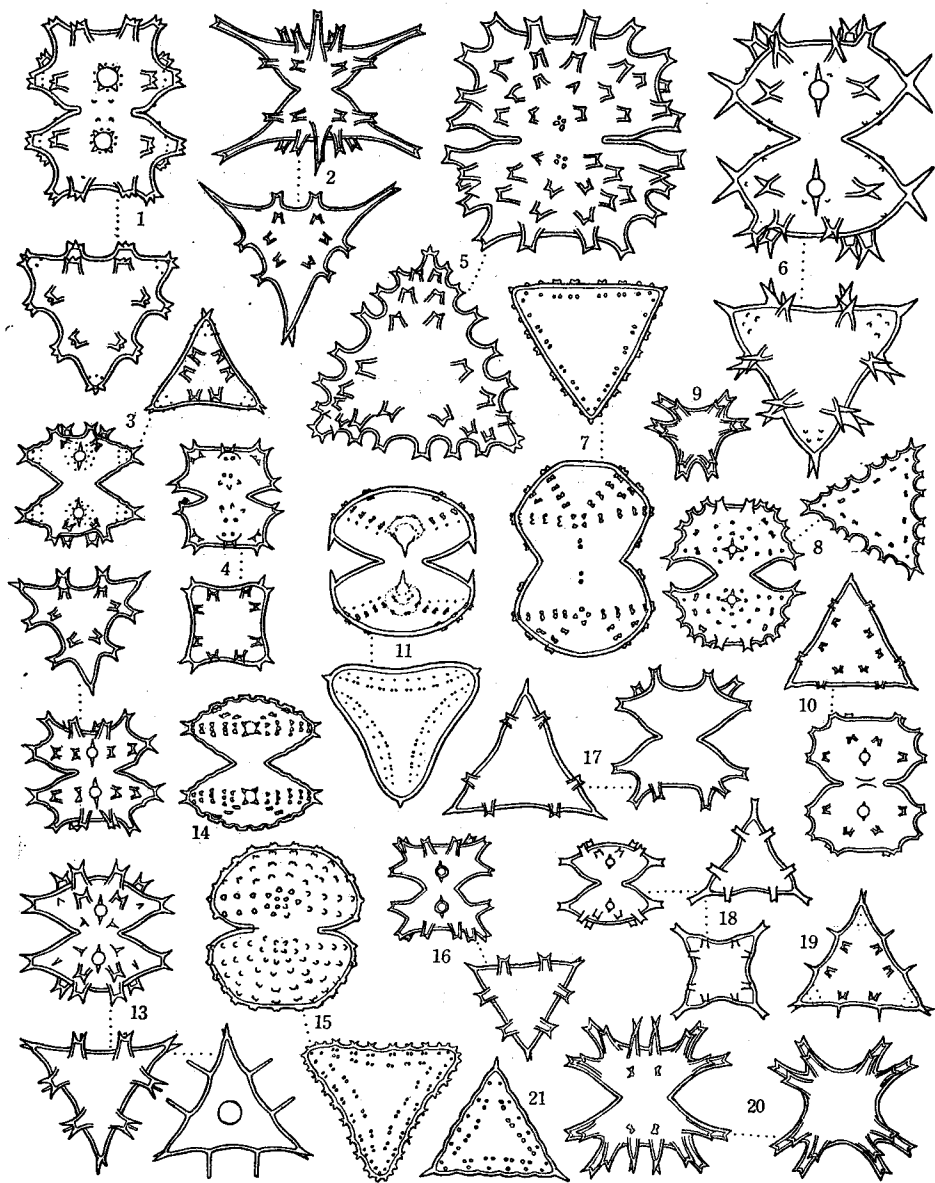
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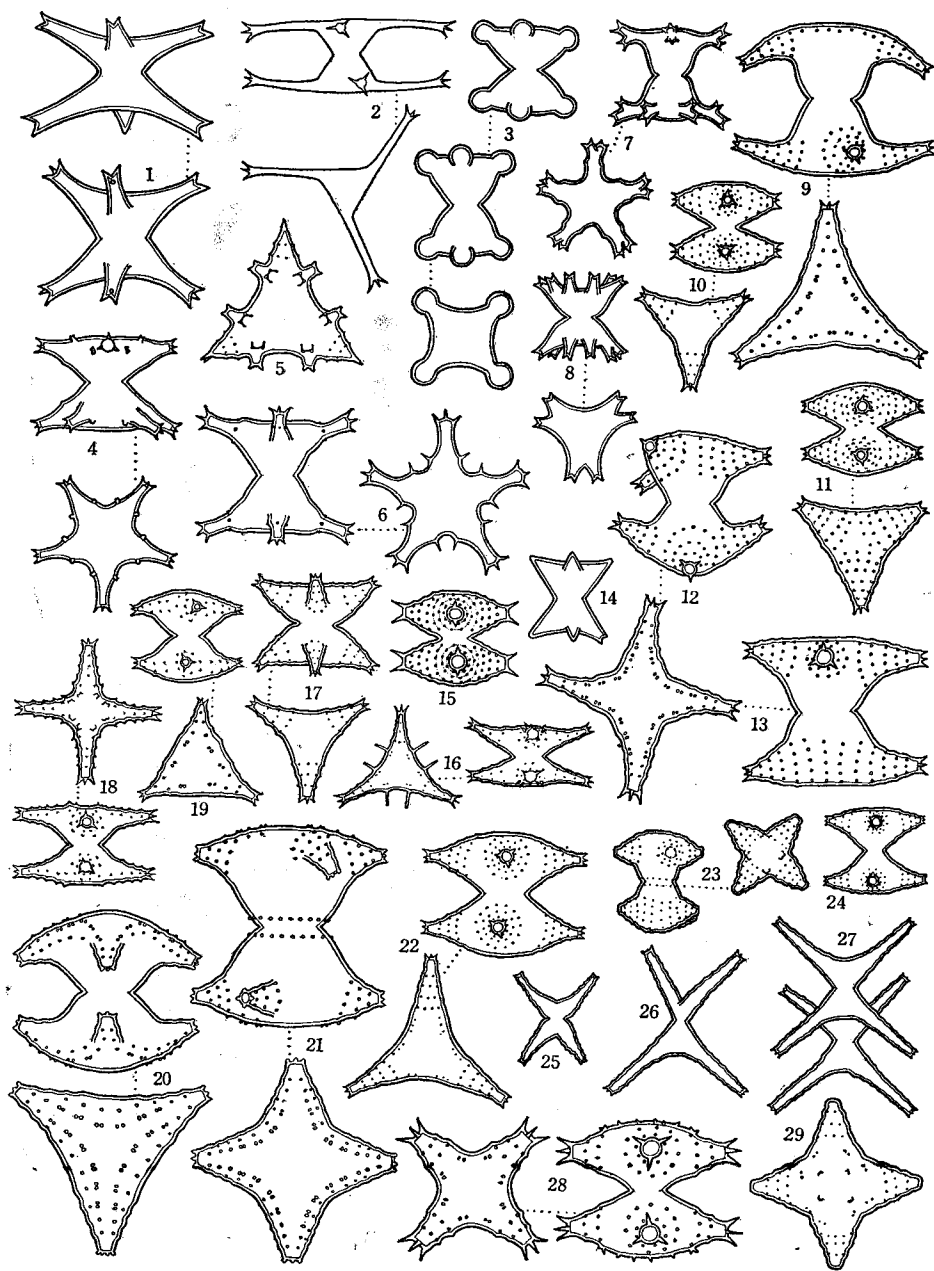
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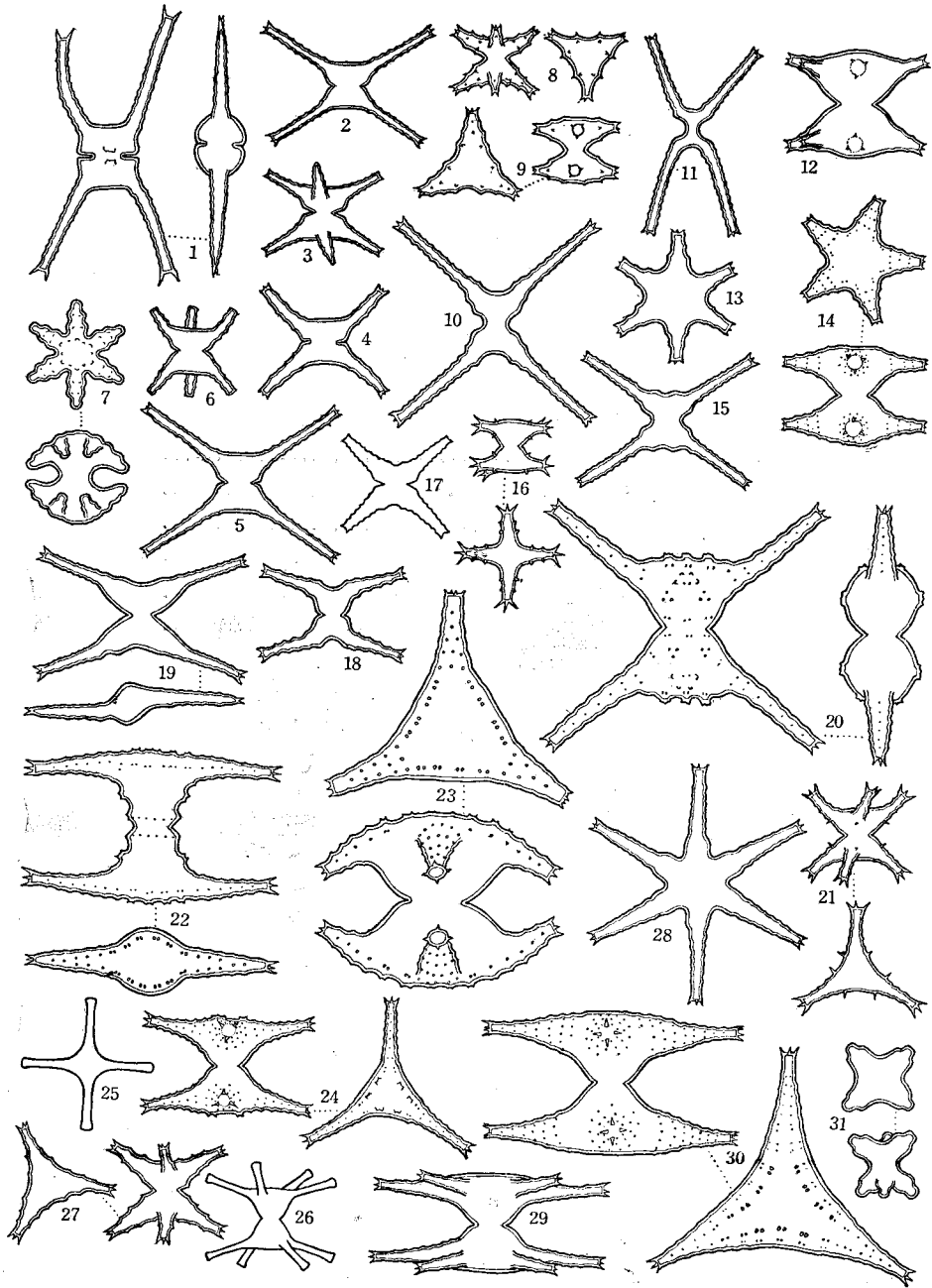




# Plate XLIV.

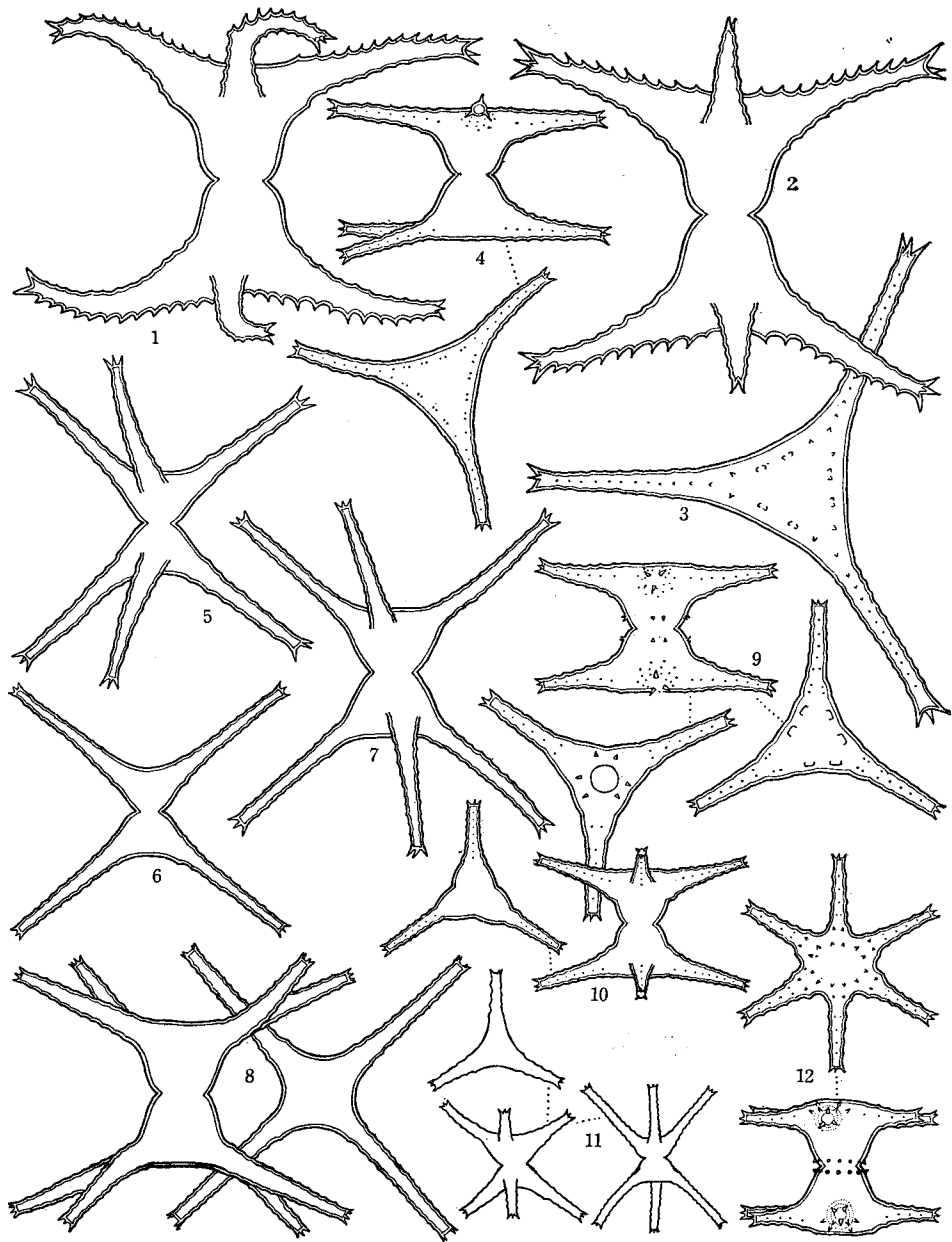
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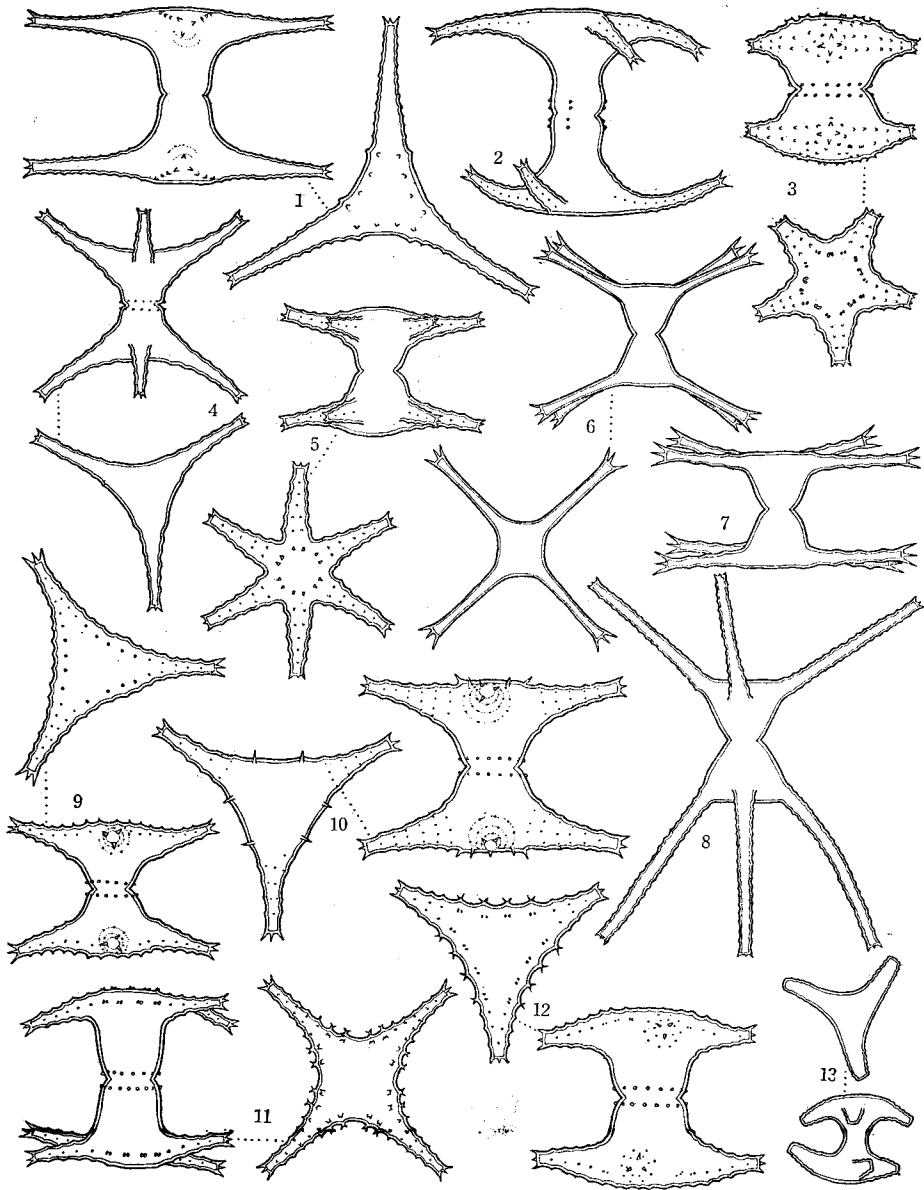
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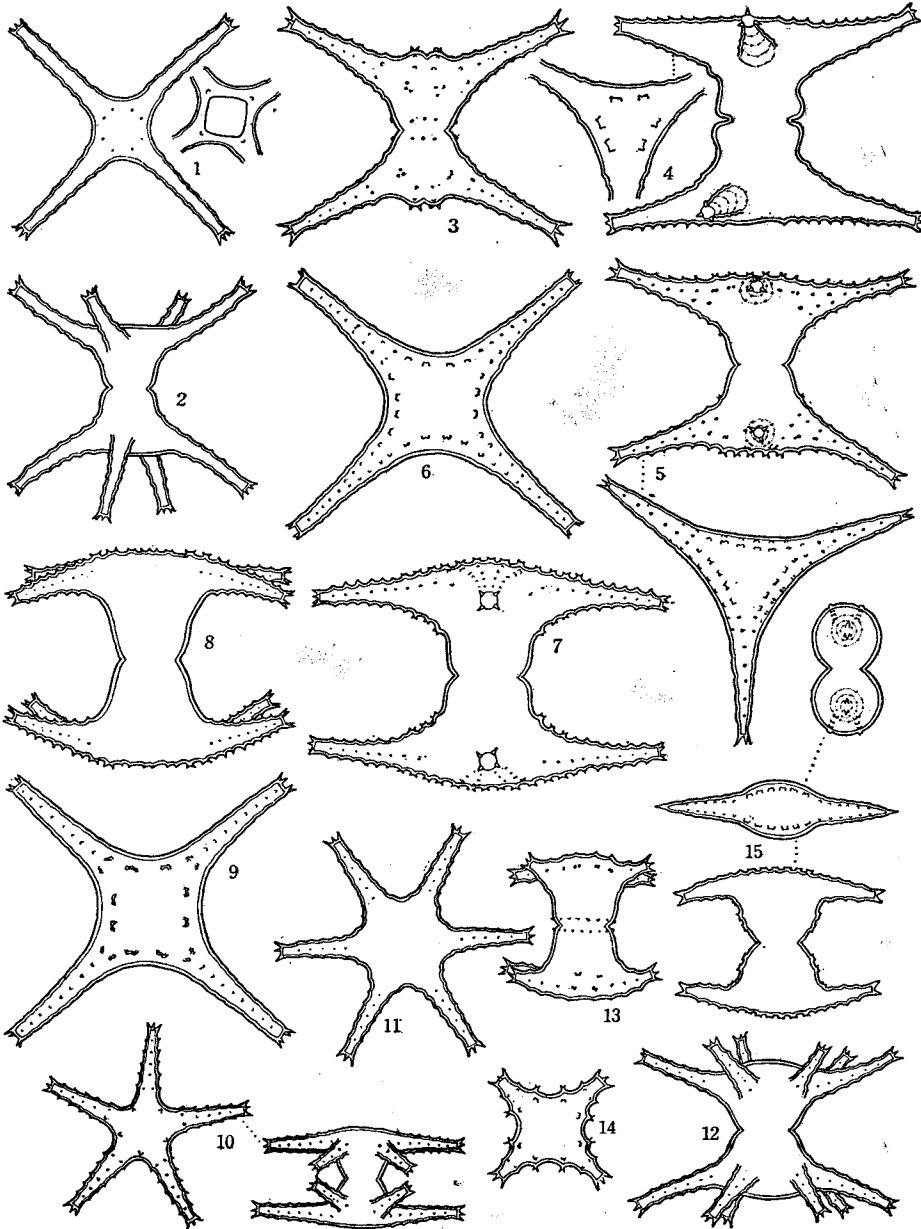
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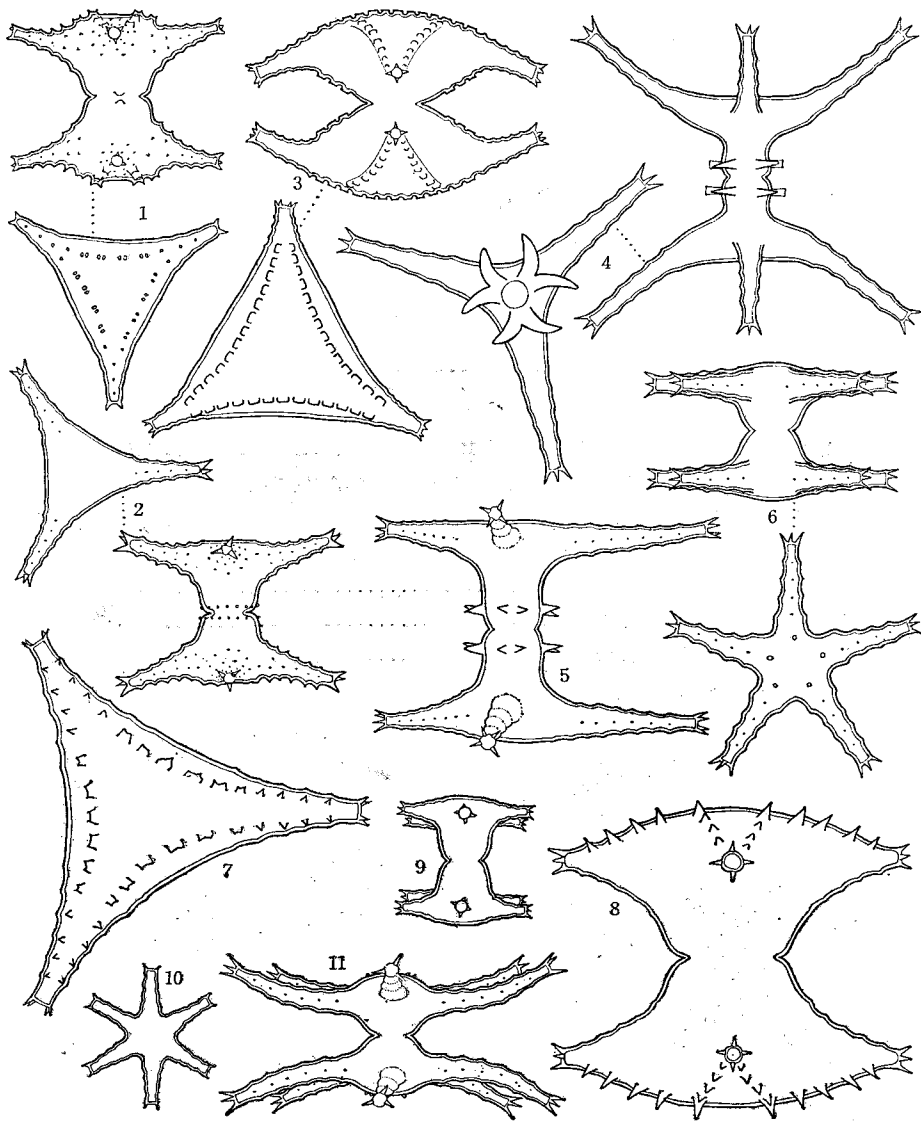
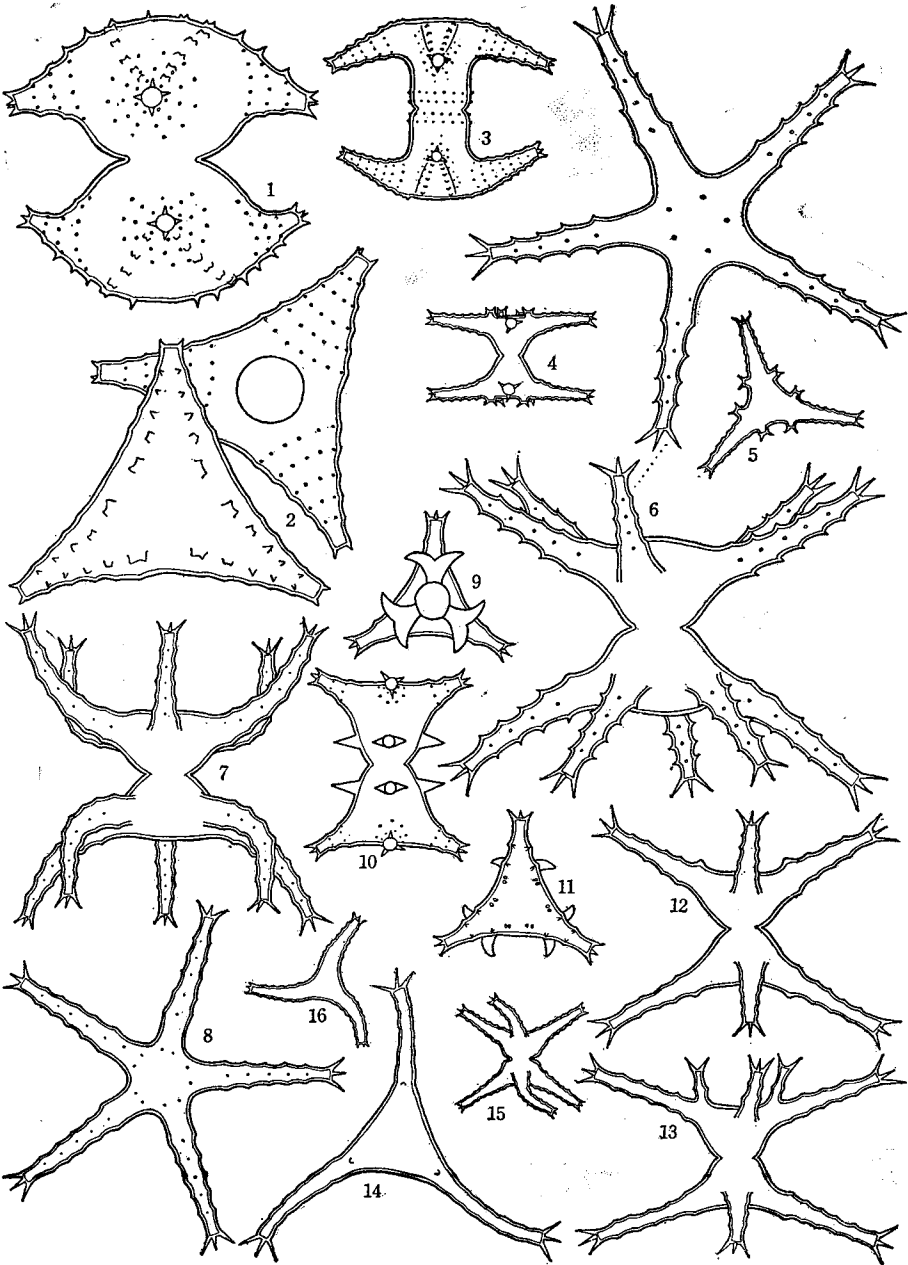


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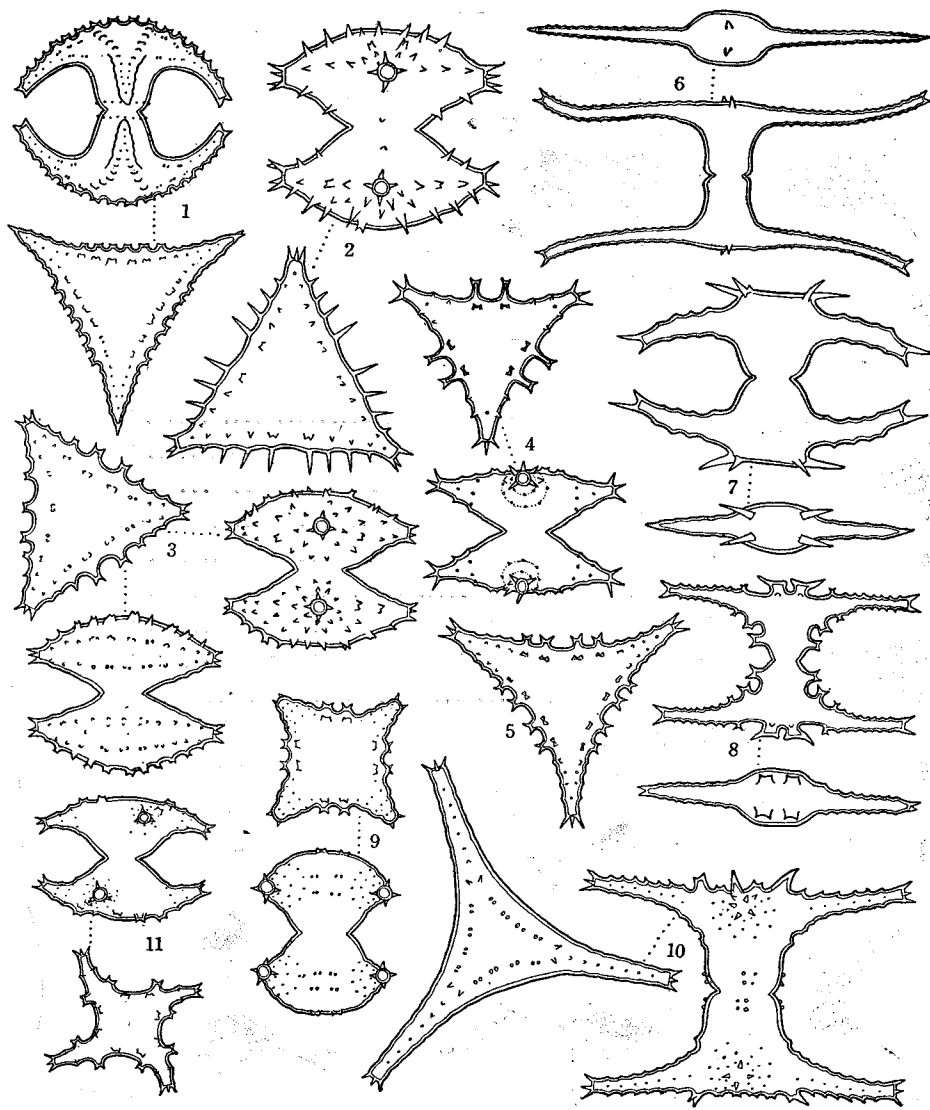
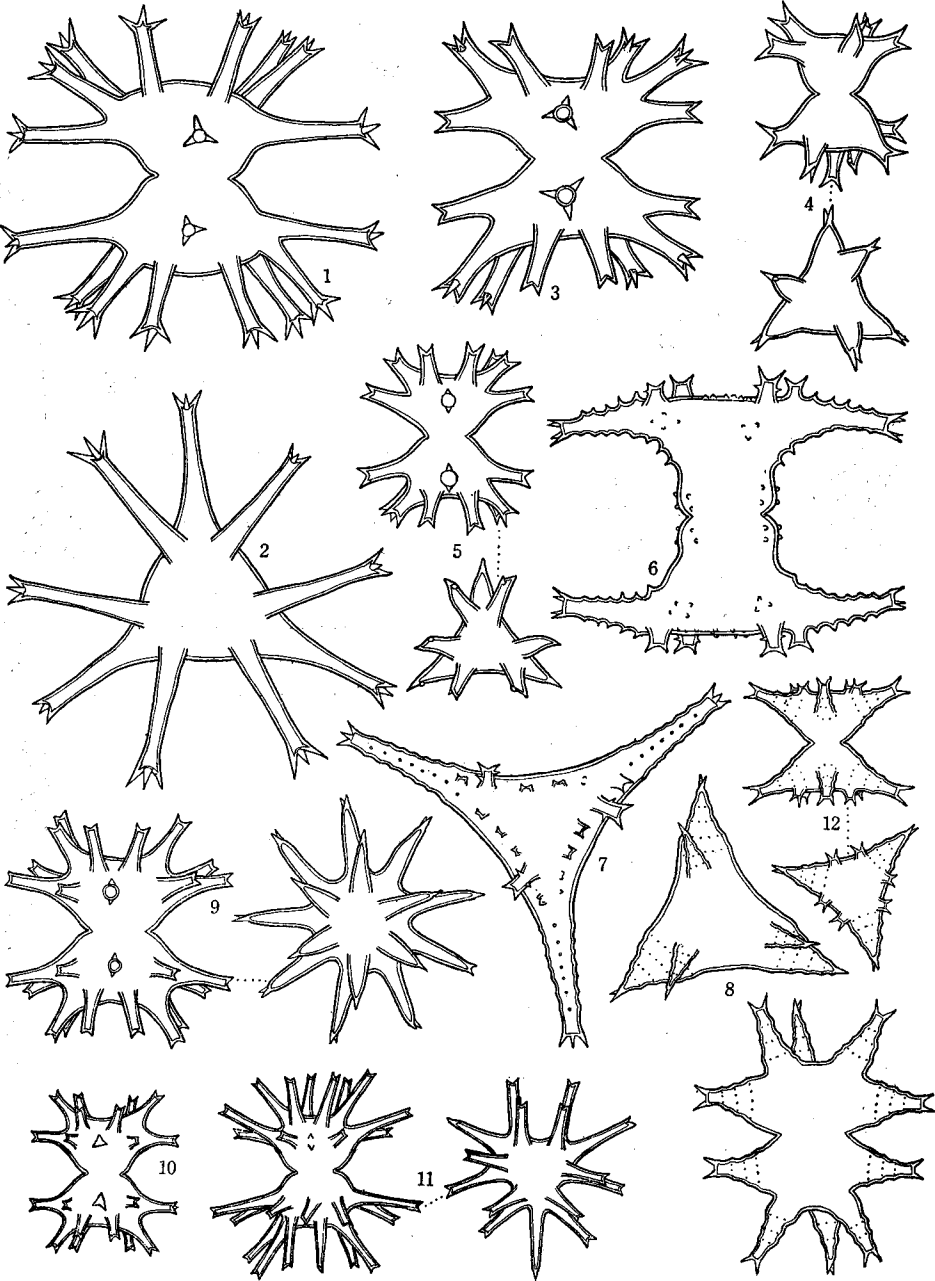


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